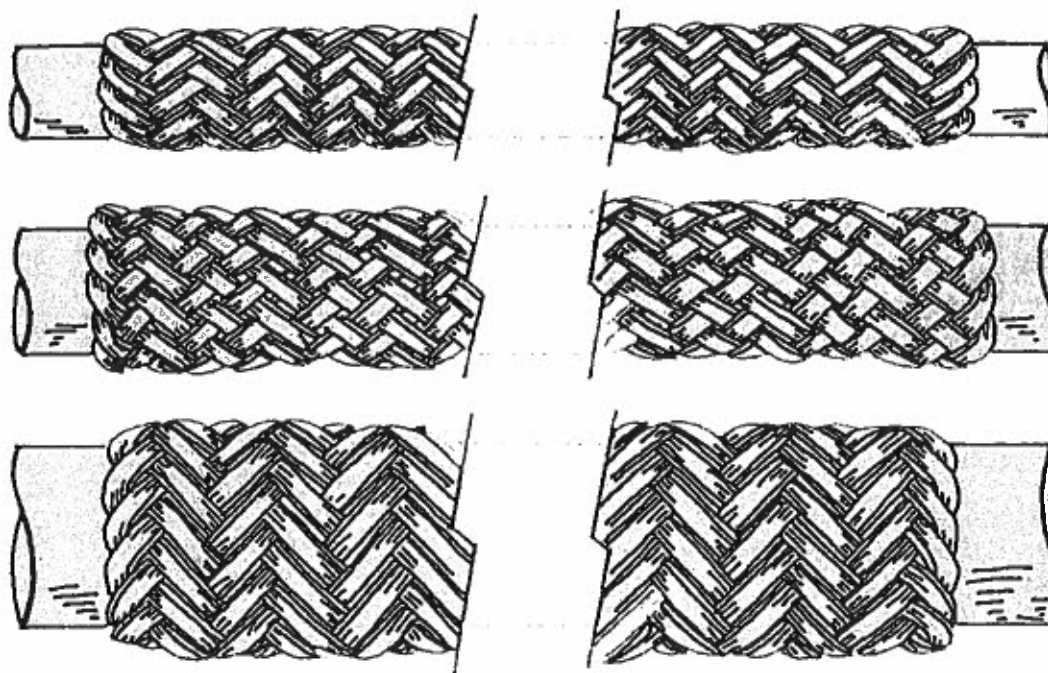


**THE BRAIDING OF
LONG REGULAR KNOTS
WITH MAXIMUM NUMBER OF
FREE-RUN HALF-CYCLES**



**A.G. Schaake
T. Hall**

Topics in Braiding Theory and Practice

Pamphlet No.13

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LONG REGULAR KNOTS
with
MAXIMUM NUMBER of FREE-RUN HALF-CYCLES

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Abstract:

The general calculation procedures for the half-cycle algorithms of Long Regular Knots which have the maximum number of free-run half-cycles is fully outlined. Furthermore, this Pamphlet forms a data-base for such knots which have from 2 to 12 bights.

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CONTENTS

	page
INTRODUCTION	1
GENERAL CONSTRUCTION METHODS and PROCEDURES for LONG REGULAR KNOTS	2
COLUMN-CODED LONG REGULAR KNOTS with MAXIMUM NUMBER of FREE-RUN HALF-CYCLES	9
3-ROW MODULAR ALGORITHM DIAGRAMS for COLUMN-CODED LONG REGULAR KNOTS with BIGHT-NUMBERS from 2 to 12, which have a MAXIMUM NUMBER of FREE-RUN HALF-CYCLES	33
GRID-DIAGRAMS for COLUMN-CODED LONG REGULAR KNOTS with BIGHT-NUMBERS from 2 to 12, which have a MAXIMUM NUMBER of FREE-RUN HALF-CYCLES	42
REFERENCES	50

PLEASE NOTE

The reader should be aware that in this pamphlet the term "Free Run" is used in a sense which differs from that of its normal usage.

In its normal usage the term "Free Run" means that the string in the half-cycle concerned does not cross an already laid down half-cycle, hence in this "Free Run" half-cycle there are neither under-crossings nor are there over-crossings. For Long Knots this will only be the case for the first half-cycle.

In this pamphlet, however, the interest is centred on the maximum number of consecutive half-cycles in which no interweaving with previous laid down half-cycles takes place. These are the first half-cycle and all its consecutive half-cycles in which only over-crossings with previous laid down half-cycles occur. It are therefore all those consecutive half-cycles which can be laid down freely, hence without interweaving. All these half-cycles we call in this Pamphlet "Free Run half-cycles".

Introduction

Long Regular Knots are Regular Knots in which the number of *parts* exceeds the number of *bights* considerably. In the Supplement to Pamphlet No. 7 we have discussed the braiding of Column-coded Long Regular Knots in general terms. Since these knots are braided from one very long string, the braiding process is quite time consuming. Nevertheless, there are many applications where for various reasons long knots braided from one string are preferable to those braided from several strings. In order to keep braiding-time and hence labour-cost down, we often use in such circumstances long knots which possess the maximum number of 'free run' half-cycles. Such knots are of necessity Column-coded and possess specific *weaving-patterns*. If we denote the number of bights by b and the number of parts by p , then we can write $p = n \cdot b + r$, wherein n is a positive integer. Since p and b have to be coprime (single string Regular Knots), it follows that b and r have to be coprime. For a given b -value, the value of r determines the *weaving-pattern* of the braid. For some applications we require a symmetrical weaving-pattern, with respect to the length-wise centre of the knot, and hence similar weaving-patterns for the two bight-boundaries. In cases where we require strict symmetry, the value of b must be even. Then there are applications for which we require different weaving-patterns for the two bight-boundaries. In such cases b must be odd. Not every weaving-pattern suits a specific application, and hence in order to save time, it is important to have available a type of data-base from which the braider can readily select the appropriate Column-coded Long Regular Knot with its half-cycle braiding algorithms. It is the intention of this Pamphlet to supply, although in a limited way, such a data-base. Furthermore, the process for calculating all the necessary data is fully discussed and hence those braiders who want to extend this data-base will be able to readily do so.

General Construction Methods and Procedures for Long Regular Knots

When braiding a Long Regular Knot, it is important not only to place the bights in their final relative positions, but also to keep them there. In order to achieve this, we must temporarily lock the string in its proper bight-positions during the construction process.

A convenient method is to use at either end of the long knot a piece of (linen) thread, positioned with a constrictor knot. Then as each half-cycle reaches its bight-position, the string is tied down with a reef knot. After the long knot has been braided, the threads are cut away. At each of the two ends of the Long Regular Knot, the bight-positions can be indicated on a narrow strip of paper which is held in place by the constrictor knot. On each paper strip, mark off the length of the circumference of the object over which the long knot will be braided, and divide this circumferential length into $2b$ equal distances (where b is equal to the number of bights of the Long Regular Knot). Mark these distances $0, 1, 2, 3, \dots, 2b$. When each strip is placed in position, the marks "0" and " $2b$ " coincide. The markings on the paper strips indicate the row-numbers of the long knot. The paper strips are placed as indicated in Fig. 1, hence when n is even we line up the "0" marks on the strips, and when n is odd we line up the "0" mark on one strip with the " b " mark on the other strip.

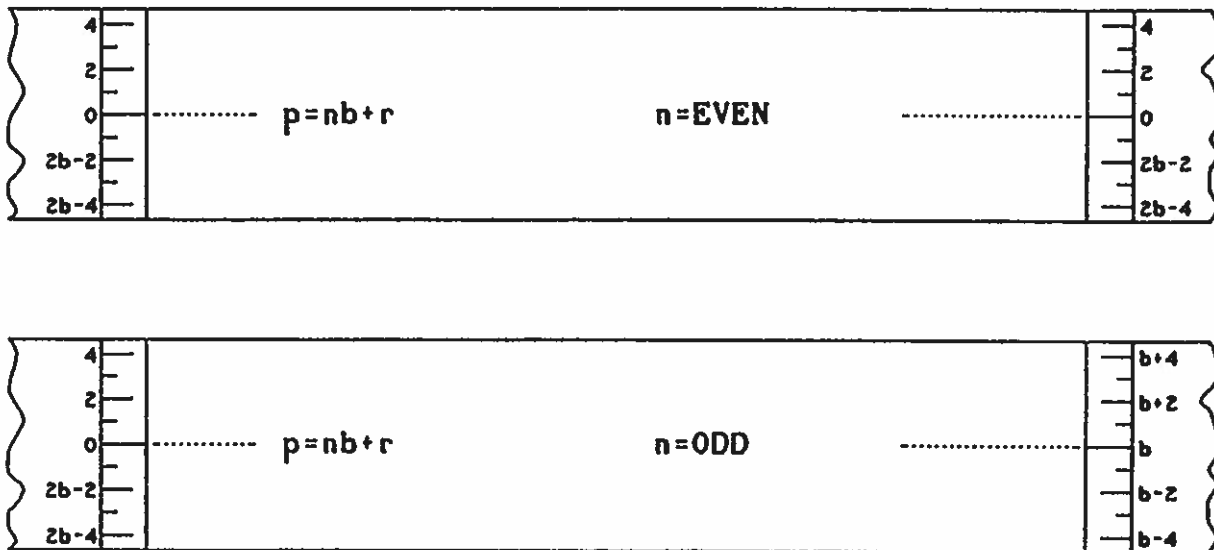


Fig. 1 — The placing of the paper strips.

Wrap the first half-cycle around the object (which is to be covered by the long knot) as many times as needed, in such a way that the string makes a 45° angle with the centreline of the object, and the "distance" between adjacent turns is equal to a little more than $(b - 1) \times$ width of string. To achieve this proper spacing, cut a strip of paper to a width of $(b - 1) \times$ width of string, and wrap this strip next to the turn laid down, then along its edge put down the next turn of the string. This will ensure

that the paper strips under the constrictor knots are placed the correct distance apart. Furthermore, by temporarily laying down the first two half-cycles (while ensuring that the crossing points lie on the two straight lines, running from the "0" and the "b" marks on the paper strips), we can by measuring the length of string used, readily determine the total length " l " of string required in the braiding of the long knot (ensure that the length of string includes extra length to compensate for "weaving loss" and for working the ends of the string away).

Since for long knots the length of string required is considerable, we do not braid the string from one end to the other, but start at such a position along the overall string-length that the number of *actual interwoven* half-cycles is for both string-parts as near the same as possible. We place this position along the overall string-length at the "0" mark of the left-hand paper strip. The upward part of the string we braid upward, and the downward part we braid downward. Since we braid the upward part first, this part contains the string-length required for the half-cycles which will be laid down without interweaving. Say the number of half-cycles which will be laid down without interweaving (hence have a free run) is equal to " f ". Then, since the total number of half-cycles is equal to $2b$, the total number of interwoven half-cycles is equal to $(2b - f)$.

When $(2b - f)$ is odd, we braid the first $\frac{2b + f + 1}{2}$ half-cycles upward, and hence we take the length of the upward string-part equal to $\frac{2b + f + 1}{4b} \times l$. The length of the downward string-part is then equal to $\frac{2b - f - 1}{4b} \times l$.

When $(2b - f)$ is even, we braid the first $\frac{2b + f}{2}$ half-cycles upward, and hence we take the length of the upward string-part equal to $\frac{2b + f}{4b} \times l$. The length of the downward string-part is then equal to $\frac{2b - f}{4b} \times l$.

If we indicate the row-numbers on the left-hand paper strip by $\mathcal{R}_l$, and on the right-hand paper strip by $\mathcal{R}_r$, then a half-cycle braided upward from Left to Right ($\nearrow$), runs from $\mathcal{R}_l$ to $\mathcal{R}_r = |\mathcal{R}_l + r|_{2b}$; a half-cycle braided upward from Right to Left ($\nwarrow$), runs from $\mathcal{R}_r$ to $\mathcal{R}_l = |\mathcal{R}_r + r|_{2b}$; a half-cycle braided downward from Left to Right ($\searrow$), runs from $\mathcal{R}_l$ to $\mathcal{R}_r = |\mathcal{R}_l - r|_{2b}$; a half-cycle braided downward from Right to Left ($\swarrow$), runs from $\mathcal{R}_r$ to $\mathcal{R}_l = |\mathcal{R}_r - r|_{2b}$.

For the derivation of the half-cycle algorithms associated with a **Column-coded Long Regular Knot**, we shall make use of its **modular algorithm-diagram**.

The modular algorithm-diagram for a **Column-coded Long Regular Knot** with p -parts and b -bights (where $p = n \cdot b + r$) consists of $(n + 1)$ rows and b columns, creating a total of $(n + 1)b$ cells. The rows, each containing b cells, are numbered from 1 to $(n + 1)$ downwards (see Figs. 2 & 3). The first cell in the first row always remains empty since it represents the left-hand bight-boundary of the knot. Then follow in the first row from left to right the coding-types (crossing-types) of the first $(b - 1)$ crossings-columns in the knot for a from Left to Right running half-cycle. The second row contains from left to right the coding-types of the next b crossings-columns in the knot for a from Left to Right running half-cycle; the third row contains from left to right the coding-types of the next b crossings-columns in the knot for a from Left to

Right running half-cycle; and so on. Finally, the $(n+1)^{th}$ row contains from left to right the coding-types of the last r crossings-columns in the knot for a from Left to Right running half-cycle.

Above the first row, the columns are numbered from left to right, for the Left to Right half-cycles, according to the complementary cyclic bight-number scheme (the complementary cyclic bight-number scheme will be discussed a little later).

Below the last row, we set off the complementary cyclic bight-number scheme from right to left, starting with 0 for the $(r+1)^{th}$ column from the left; the $(r+1)^{th}$ cell from the left in the last row represents the right-hand bight-boundary of the knot, and hence is the first empty cell from the left in this row.

For the Left to Right half-cycles, the rows are read from left to right, and in consecutive order from the top of the table downwards. For the Right to Left half-cycles, the rows are read from right to left, and in consecutive order from the bottom of the table upwards.

Thus the number of cells, in the modular algorithm-diagram, which receive a coding (the coding-cells) is equal to $(p-1)$. Each such cell represents one of the $(p-1)$ crossing-columns (intersection-columns) of the knot. Consequently the coding of a cell is the coding of every crossing (intersection) on the associated intersection-column of the knot, hence the modular algorithm-diagram as presented here is the modular algorithm-diagram of a Column-coded knot.

The complementary cyclic bight-number scheme consists of a sequence of integers i_j (the bight-numbers) with $j = 1, 2, 3, \dots, b$. In general form it is written as follows:

$$i_1, i_2, i_3, \dots, i_j, \dots, i_{b-1}, i_b \quad \text{with } i_1 = 0.$$

The entries i_{j+1} are calculated by means of the formula:

$$i_{j+1} = |i_j + \Delta^*|_b.$$

Since $|\Delta^* \cdot |p|_b|_b = b-1$, the value of Δ^* can be calculated with the formula:

$$\Delta^* = \frac{n^* \cdot b - 1}{r} = \frac{n^* \cdot b - 1}{|p|_b},$$

where n^* is the smallest positive integer so that $(n^* \cdot b - 1)$ is a multiple of r .

Since $|\Delta^* \cdot |-p|_b|_b = 1$, the value of Δ^* can also be calculated with the formula:

$$\Delta^* = \frac{n^{**} \cdot b + 1}{b-r} = \frac{n^{**} \cdot b + 1}{|-p|_b},$$

where n^{**} is the smallest positive integer so that $(n^{**} \cdot b + 1)$ is a multiple of $(b-r)$.

For each column of the modular algorithm-diagram, the sum S_1 of the bight-numbers above and below the rows (for the Left to Right and the Right to Left half-cycles) is an invariant (is constant) and equal to $(b-1)$. Only when b is odd is there a column which has the same bight-number above and below the rows of the diagram. It can readily be shown (either by means of a rather nice little analytical proof, or by means of a more geometrical proof) that this column, which carries bight-number $\left(\frac{b-1}{2}\right)$, is the $\left(\frac{r}{2} + 1\right)^{th}$ column from the left when r is even, and is the $\left(\frac{r+b}{2} + 1\right)^{th}$ column from the left when r is odd.

Since every knot is braided in exact half-cycle movements, each half-cycle is associated with a bight-number, except the first one which is always a free run. The

half-cycles are numbered in sequential order as they are laid down. Thus, first we lay down half-cycle 1 (which is always a free run), then half-cycle 2, then half-cycle 3, then half-cycle 4, and so on. Hence we have **odd half-cycles** and **even half-cycles**.

Suppose an even half-cycle has the number h_e , then its associated bight-number i is equal to:

$$i = \frac{h_e - 2}{2};$$

and suppose an odd half-cycle has the number h_o , then its associated bight-number i is equal to:

$$i = \frac{h_o - 3}{2}.$$

We can either braid directly from the modular algorithm-diagram or tabulate from it the braiding-algorithms for the consecutive half-cycles. In both cases the following rule applies:

A half-cycle (even or odd) which is associated with bight-number i , intersects all column-numbers which in the algorithm-diagram correspond to the bight-numbers which are equal to or less than i .

The greater the number of free run half-cycles a long regular knot possesses, the quicker and easier it can be braided. Since we can freely choose the codings for all coding-cells of the modular algorithm-diagram, we can give all the coding-cells in a column the same coding, and consequently there are for a Column-coded Long Regular Knot a maximum of $(b + 1)$ halfcycles with a free run.

	LR						
	0	5	3	1	6	4	2
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
	6	1	3	5	0	2	4
	LR						

Fig. 2 — The skeleton modular algorithm-diagram; $p = 67$; $b = 7$.

The following Example illustrates the above discussed procedures.

Example 1 :

Say a Column-coded Long Regular Knot has 67 parts and 7 bights.

Then:

$$r = |p|_b = |67|_7 = 4,$$

$$\Delta^* = \frac{n^* \cdot b - 1}{r} = \frac{n^* \cdot 7 - 1}{4} = \frac{3 \times 7 - 1}{4} = 5.$$

$$b - r = |-p|_b = |-67|_7 = 3,$$

$$\Delta^* = \frac{n^{**} \cdot b + 1}{b - r} = \frac{n^{**} \cdot 7 + 1}{3} = \frac{2 \times 7 + 1}{3} = 5.$$

Hence for the complementary cyclic bight-number scheme we obtain the sequence:

$$0, 5, 3, 1, 6, 4, 2.$$

The skeleton modular algorithm-diagram can now be drawn up (see Fig.2). The heavy framed cells will receive their associated codings. Since a Column-coded Regular Knot has $(p-1)$ intersection-columns, its skeleton modular algorithm-diagram will have $(p-1)$ heavy framed cells. Hence 66 heavy framed cells for the knot in this Example.

As mentioned before, the greater the number of free run half-cycles a long regular knot possesses, the quicker and easier it can be braided. We also mentioned that the maximum possible number of half-cycles with a free run is equal to $(b+1)$, and is associated with a Column-coded Regular Knot (hence in our Example the maximum number of free run half-cycles is equal to 8).

The first half-cycle, from Left to Right upwards, is always a free run.

The second half-cycle, from Right to Left upwards, is associated with lower bight-number 0. For this half-cycle to have a free run, we give each coding-cell in the fifth column (of the modular algorithm-diagram) from the left the coding "\".

The third half-cycle, from Left to Right upwards, is associated with upper bight-number 0. For this half-cycle to have a free run, we give each coding-cell in the first column (of the modular algorithm-diagram) from the left the coding "/".

The fourth half-cycle, from Right to Left upwards, is associated with lower bight-number 1. For this half-cycle to have a free run, we give each coding-cell in the second column (of the modular algorithm-diagram) from the left the coding "\".

The fifth half-cycle, from Left to Right upwards, is associated with upper bight-number 1. For this half-cycle to have a free run, we give each coding-cell in the fourth column (of the modular algorithm-diagram) from the left the coding "/".

The sixth half-cycle, from Right to Left upwards, is associated with lower bight-number 2. For this half-cycle to have a free run, we give each coding-cell in the sixth column (of the modular algorithm-diagram) from the left the coding "\".

The seventh half-cycle, from Left to Right upwards, is associated with upper bight-number 2. For this half-cycle to have a free run, we give each coding-cell in the seventh column (of the modular algorithm-diagram) from the left the coding "/".

The eighth half-cycle, from Right to Left upwards, is associated with lower bight-number 3. For this half-cycle to have a free run, we give each coding-cell in the third column (of the modular algorithm-diagram) from the left the coding "\".

Since all the coding-cells in the modular algorithm-diagram have received a coding (see Fig.3), the remaining $(b-1)$ half-cycles, hence the remaining 6 half cycles, will

have to be interwoven with the 8 already laid down half-cycles. Hence we shall braid a further 3 half-cycles upwards, and the last 3 half-cycles will be braided downwards.

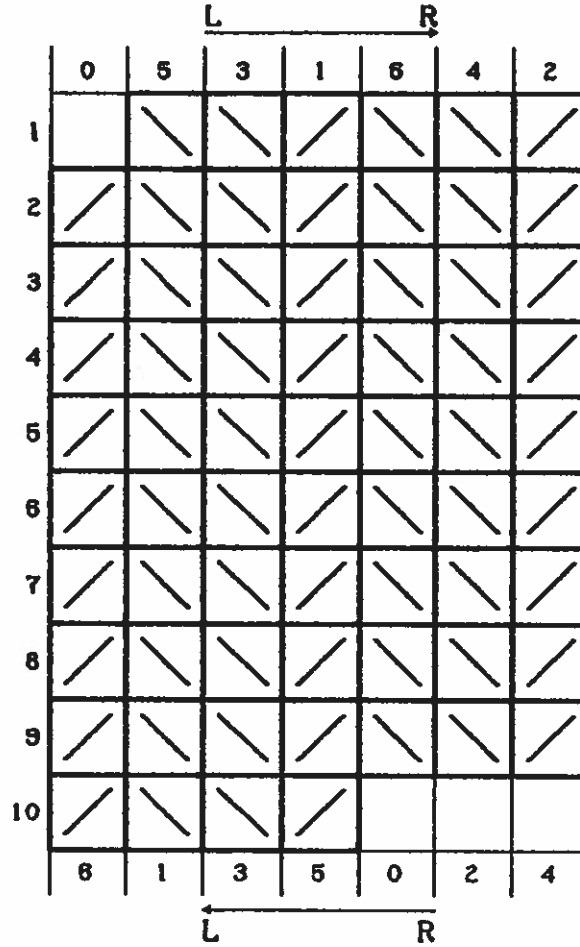


Fig. 3 — The modular algorithm-diagram.

When the total string-length required is l , then with $(2b - f)$ being even ($= 6$), we braid the first $\frac{2b+f}{2} = 11$ half-cycles upward, and hence we take the length of the upward string-part equal to $\frac{2b+f}{4b} \times l = \frac{11}{14}l$. The length of the downward string-part is then $\frac{2b-f}{4b} \times l = \frac{3}{14}l$.

After laying down the first 8 free run half-cycles in the upwards braiding direction, starting on the left-hand bight-boundary, we continue in the upwards braiding direction with half-cycle 9 running from Left to Right. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the upper bight-numbers 0, 1, 2, 3. Hence the braiding algorithm for the 9th half-cycle is:

$$u - 2o - o - u - 2o - \dots - o - u - 2o - o - u - o.$$

Thus its braiding-algorithm is: Start and repeat with: $u - 3o$; finish with: $u - o$.

Then follows the 10th half-cycle upwards from Right to Left. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the lower bight-numbers 0, 1, 2, 3, 4. Hence the braiding algorithm for the 10th half-cycle is:

$$2o - u - 4o - \dots - u - 4o - u - 4o.$$

Thus its braiding-algorithm is: Start with: $2o$; repeat with: $u - 4o$.

Next follows the 11th half-cycle upwards from Left to Right. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the upper bight-numbers 0, 1, 2, 3, 4. Hence the braiding algorithm for the 11th half-cycle is:

$$u - o - u - o - o - u - o - u - o - \dots - o - u - o - u - o - o - u - o.$$

Thus its braiding-algorithm is: Start and repeat with: $u - o - u - 2o$; finish with: $u - o$.

This completes the braiding of the long part of the string. Now follows the braiding of the short part of the string. For this it is as if our initial braiding start is the end point of the last interwoven half-cycle. Hence the 12th half-cycle is the first half-cycle braided with the short part of the string; this half-cycle runs from Left to Right downwards. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the upper bight-numbers 0, 1, 2, 3, 4, 5. Hence the braiding algorithm for the 12th half-cycle is:

$$2o - u - o - u - u - 2o - u - o - u - \dots - u - 2o - u - o - u - u - 2o - u.$$

Thus its braiding-algorithm is: Start and repeat with: $2o - u - o - 2u$; finish with: $2o - u$.

Then follows the 13th half-cycle downwards from Right to Left. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the lower bight-numbers 0, 1, 2, 3, 4, 5. Hence the braiding algorithm for the 13th half-cycle is:

$$o - 2u - o - 2u - o - 2u - \dots - o - 2u - o - 2u - o - 2u - o - 2u.$$

Thus its braiding-algorithm is: Start and repeat with: $o - 2u$.

Next follows the 14th half-cycle downwards from Left to Right. The intersection-columns associated with this half-cycle are those in the modular algorithm-diagram columns which carry the upper bight-numbers 0, 1, 2, 3, 4, 5, 6. Hence the braiding algorithm for the 14th half-cycle is:

$$2o - u - 2o - u - u - 2o - u - 2o - u - \dots - u - 2o - u - 2o - u - u - 2o - u.$$

Thus its braiding-algorithm is: Start with: $2o - u$; repeat with: $2o - 2u - 2o - u$.

Besides from working away the ends, this completes the braiding of the knot.

It will be evident that Column-coded Long Regular Knots with the maximum number of free run half-cycles (hence $(b + 1)$ free run half-cycles), all have identical sets of braiding half-cycle algorithms when they have the same number of bights (b) and the same value for r .

Hence Column-coded Long Regular Knots with 7-bights and $(7n + 4)$ -parts, where n is a positive integer, all have identical sets of half-cycle braiding algorithms when they possess the maximum possible number of free run half-cycles.

It will also be evident that we do not require the complete modular algorithm-diagrams for such knots, but that the first row, the last row, and a row in between is all that is required for the derivation of the braiding half-cycle algorithms.

Hence in future we shall employ such abbreviated modular algorithm-diagrams for Column-coded Long Regular Knots which have a maximum number of free run half-cycles.

Column-coded Long Regular Knots with Maximum Number of Free-run Half-cycles

In the previous chapter we have seen that for Column-coded Long Regular Knots the maximum number of free-run half-cycles is equal to $(b + 1)$, where b is the number of bights. We have also seen that we don't require the full modular algorithm-diagram for such knots, but that a 3-row modular algorithm-diagram suffices. In this chapter we shall discuss the Column-coded Long Regular Knots with maximum number of free-run half-cycles which have b -values from 2 to 12. The overall coding-pattern of such knots can readily be seen from their 3-row algorithm-diagrams. When the number of parts is equal to $p = bn + r$ (where b is the number of bights and n is a positive integer), then, for a given b -value, the coding-pattern is determined by the r -value. In general, a suitable coding-pattern has near the two bight-boundaries local coding-patterns which are of the same nature. This will always be the case when b is even; in fact the knot has then always a coding which is symmetric relative to its mid-length centre. When b is odd, the knot never has a coding which is symmetric relative to its mid-length centre, since in that case there is a column in the modular algorithm-diagram which carries for the Left to Right half-cycles as well as for the Right to Left half-cycles the same bight-number (see pg. 4), and the coding of the cells in this column is always such that the $(b + 1)^{th}$ half-cycle has a free run. As we have seen in the Supplement to Pamphlet No. 7, we can give a Column-coded Long Regular Knot which has an odd b -value, and an odd number of parts, a symmetric coding relative to its length-wise centre, but then the maximum number of free-run half-cycles is only equal to b . Hence Column-coded Long Regular Knots with an odd number of bights and the maximum number of free-run half-cycles are generally more suited to special applications where different local coding-patterns near the two bight-boundaries are required or acceptable.

The 3-row modular algorithm-diagrams and the half-cycle algorithms for the various b -values:

$b=2$:

$p = 2n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 33.

This is the only Column-coded Long Regular Knot which we braid from one end of the string to the other end since it has only one half-cycle which has to be interwoven.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=0$: Start and repeat with: $u - o$.

$b=3$:

$p = 3n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 33.

Place string-length position $\frac{5}{6}l$ at left bight-boundary position 0. Braid first 5 half-cycles upwards; braid the 6^{th} half-cycle downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Start and repeat with: $u - o$.
- (6). $L=0 \longrightarrow R=5$: Start and repeat with: $2o - u$.

b=3:

$p = 3n + 2$; hence $r = 2$. For 3-row algorithm-diagram see pg.33.

Place string-length position $\frac{5}{6}l$ at left bight-boundary position 0. Braid first 5 half-cycles upwards; braid the 6^{th} half-cycle downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=2$: Free Run.
- (2). $R=2 \longrightarrow L=4$: Free Run.
- (3). $L=4 \longrightarrow R=0$: Free Run.
- (4). $R=0 \longrightarrow L=2$: Free Run.
- (5). $L=2 \longrightarrow R=4$: Start and repeat with: $u - o$; finish with: u .
- (6). $L=0 \longrightarrow R=4$: Start and repeat with: $2o - u$; finish with: o .

b=4:

$p = 4n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg.33.

Place string-length position $\frac{7}{8}l$ at left bight-boundary position 0. Braid first 7 half-cycles upwards; braid the 8^{th} half-cycle downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=6$: Start and repeat with: $u - 2o$.
- (7). $L=6 \longrightarrow R=7$: Start and repeat with: $u - 2o$.
- (8). $L=0 \longrightarrow R=7$: Start and repeat with: $2o - 2u$.

b=4:

$p = 4n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg.33.

Place string-length position $\frac{7}{8}l$ at left bight-boundary position 0. Braid first 7 half-cycles upwards; braid the 8^{th} half-cycle downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=3$: Free Run.
- (2). $R=3 \longrightarrow L=6$: Free Run.
- (3). $L=6 \longrightarrow R=1$: Free Run.
- (4). $R=1 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=7$: Free Run.
- (6). $R=7 \longrightarrow L=2$: Start with: $o - u$; repeat with: $2o - u$.
- (7). $L=2 \longrightarrow R=5$: Start with: $o - u$; repeat with: $2o - u$.
- (8). $L=0 \longrightarrow R=5$: Start with: u ; repeat with: $2o - 2u$; finish with: o .

b=5:

$p = 5n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 33.

Place string-length position $\frac{4}{5}l$ at left bight-boundary position 0. Braid first 8 half-cycles upwards; braid the half-cycles 9 and 10 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=6$: Free Run.
- (7). $L=6 \longrightarrow R=7$: Start and repeat with: $u - 2o$.
- (8). $R=7 \longrightarrow L=8$: Start and repeat with: $u - 3o$.
- (9). $L=0 \longrightarrow R=9$: Start and repeat with: $2o - 2u$.
- (10). $R=9 \longrightarrow L=8$: Start and repeat with: $2o - 3u$.

b=5:

$p = 5n + 2$; hence $r = 2$. For 3-row algorithm-diagram see pg. 33.

Place string-length position $\frac{4}{5}l$ at left bight-boundary position 0. Braid first 8 half-cycles upwards; braid the half-cycles 9 and 10 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=2$: Free Run.
- (2). $R=2 \longrightarrow L=4$: Free Run.
- (3). $L=4 \longrightarrow R=6$: Free Run.
- (4). $R=6 \longrightarrow L=8$: Free Run.
- (5). $L=8 \longrightarrow R=0$: Free Run.
- (6). $R=0 \longrightarrow L=2$: Free Run.
- (7). $L=2 \longrightarrow R=4$: Start with: u ; repeat with: $2o - u$.
- (8). $R=4 \longrightarrow L=6$: Start with: $2o - u$; repeat with: $3o - u$; finish with: $2o$.
- (9). $L=0 \longrightarrow R=8$: Start with: o ; repeat with: $u - o$.
- (10). $R=8 \longrightarrow L=6$: Start with: u ; repeat with: $o - u - o - 2u$.

b=5:

$p = 5n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg. 33.

Place string-length position $\frac{4}{5}l$ at left bight-boundary position 0. Braid first 8 half-cycles upwards; braid the half-cycles 9 and 10 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=3$: Free Run.
- (2). $R=3 \longrightarrow L=6$: Free Run.
- (3). $L=6 \longrightarrow R=9$: Free Run.
- (4). $R=9 \longrightarrow L=2$: Free Run.
- (5). $L=2 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=8$: Free Run.
- (7). $L=8 \longrightarrow R=1$: Start with: o ; repeat with: $u - 2o$.
- (8). $R=1 \longrightarrow L=4$: Start and repeat with: $u - 3o$; finish with: $u - o$.
- (9). $L=0 \longrightarrow R=7$: Start and repeat with: $o - u$.
- (10). $R=7 \longrightarrow L=4$: Start with: $o - u$; repeat with: $o - 2u - o - u$.

b=5:

$p = 5n + 4$; hence $r = 4$. For 3-row algorithm-diagram see pg. 33.

Place string-length position $\frac{4}{5}l$ at left bight-boundary position 0. Braid first 8 half-cycles upwards; braid the half-cycles 9 and 10 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=4$: Free Run.
- (2). $R=4 \rightarrow L=8$: Free Run.
- (3). $L=8 \rightarrow R=2$: Free Run.
- (4). $R=2 \rightarrow L=6$: Free Run.
- (5). $L=6 \rightarrow R=0$: Free Run.
- (6). $R=0 \rightarrow L=4$: Free Run.
- (7). $L=4 \rightarrow R=8$: Start with: $o - u$; repeat with $2o - u$.
- (8). $R=8 \rightarrow L=2$: Start with: $2o - u$; repeat with $3o - u$.
- (9). $L=0 \rightarrow R=6$: Start with: $u - 2o$; repeat with: $2u - 2o$.
- (10). $R=6 \rightarrow L=2$: Start with: $2u$; repeat with: $2o - 3u$; finish with: o .

b=6:

$p = 6n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{5}{6}l$ at left bight-boundary position 0. Braid first 10 half-cycles upwards; braid the half-cycles 11 and 12 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=1$: Free Run.
- (2). $R=1 \rightarrow L=2$: Free Run.
- (3). $L=2 \rightarrow R=3$: Free Run.
- (4). $R=3 \rightarrow L=4$: Free Run.
- (5). $L=4 \rightarrow R=5$: Free Run.
- (6). $R=5 \rightarrow L=6$: Free Run.
- (7). $L=6 \rightarrow R=7$: Free Run.
- (8). $R=7 \rightarrow L=8$: Start and repeat with: $u - 3o$.
- (9). $L=8 \rightarrow R=9$: Start and repeat with: $u - 3o$.
- (10). $R=9 \rightarrow L=10$: Start and repeat with: $2u - 3o$.
- (11). $L=0 \rightarrow R=11$: Start and repeat with: $2o - 3u$.
- (12). $R=11 \rightarrow L=10$: Start and repeat with: $3o - 3u$.

b=6:

$p = 6n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{5}{6}l$ at left bight-boundary position 0. Braid first 10 half-cycles upwards; braid the half-cycles 11 and 12 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=5$: Free Run.
- (2). $R=5 \rightarrow L=10$: Free Run.
- (3). $L=10 \rightarrow R=3$: Free Run.
- (4). $R=3 \rightarrow L=8$: Free Run.
- (5). $L=8 \rightarrow R=1$: Free Run.
- (6). $R=1 \rightarrow L=6$: Free Run.
- (7). $L=6 \rightarrow R=11$: Free Run.
- (8). $R=11 \rightarrow L=4$: Start with: $2o - u$; repeat with: $3o - u$.
- (9). $L=4 \rightarrow R=9$: Start with: $2o - u$; repeat with: $3o - u$.

- (10). $R=9 \rightarrow L=2$: Start with: $2o - 2u$; repeat with: $3o - 2u$.
 (11). $L=0 \rightarrow R=7$: Start with: $2u - 2o$; repeat with: $3u - 2o$.
 (12). $R=7 \rightarrow L=2$: Start with: $2u$; repeat with: $3o - 3u$; finish with: $2o$.

b=7:

$p = 7n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=1$: Free Run.
- (2). $R=1 \rightarrow L=2$: Free Run.
- (3). $L=2 \rightarrow R=3$: Free Run.
- (4). $R=3 \rightarrow L=4$: Free Run.
- (5). $L=4 \rightarrow R=5$: Free Run.
- (6). $R=5 \rightarrow L=6$: Free Run.
- (7). $L=6 \rightarrow R=7$: Free Run.
- (8). $R=7 \rightarrow L=8$: Free Run.
- (9). $L=8 \rightarrow R=9$: Start and repeat with: $u - 3o$.
- (10). $R=9 \rightarrow L=10$: Start and repeat with: $u - 4o$.
- (11). $L=10 \rightarrow R=11$: Start and repeat with: $2u - 3o$.
- (12). $L=0 \rightarrow R=13$: Start and repeat with: $3o - 3u$.
- (13). $R=13 \rightarrow L=12$: Start and repeat with: $2o - 4u$.
- (14). $L=12 \rightarrow R=11$: Start and repeat with: $4o - 3u$.

b=7:

$p = 7n + 2$; hence $r = 2$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=2$: Free Run.
- (2). $R=2 \rightarrow L=4$: Free Run.
- (3). $L=4 \rightarrow R=6$: Free Run.
- (4). $R=6 \rightarrow L=8$: Free Run.
- (5). $L=8 \rightarrow R=10$: Free Run.
- (6). $R=10 \rightarrow L=12$: Free Run.
- (7). $L=12 \rightarrow R=0$: Free Run.
- (8). $R=0 \rightarrow L=2$: Free Run.
- (9). $L=2 \rightarrow R=4$: Start with: u ; repeat with: $3o - u$.
- (10). $R=4 \rightarrow L=6$: Start with: $3o - u$; repeat with: $4o - u$; finish with: $2o$.
- (11). $L=6 \rightarrow R=8$: Start and repeat with: $u - 2o - u - o$; finish with: u .
- (12). $L=0 \rightarrow R=12$: Start with: o ; repeat with: $u - o$.
- (13). $R=12 \rightarrow L=10$: Start with: $2u - o - u - o$; repeat with: $3u - o - u - o$; finish with: $2u$.
- (14). $L=10 \rightarrow R=8$: Start and repeat with: $2o - u - o - u - o - u$; finish with: o .

$b=7$:

$p = 7n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=3$: Free Run.
- (2). $R=3 \rightarrow L=6$: Free Run.
- (3). $L=6 \rightarrow R=9$: Free Run.
- (4). $R=9 \rightarrow L=12$: Free Run.
- (5). $L=12 \rightarrow R=1$: Free Run.
- (6). $R=1 \rightarrow L=4$: Free Run.
- (7). $L=4 \rightarrow R=7$: Free Run.
- (8). $R=7 \rightarrow L=10$: Free Run.
- (9). $L=10 \rightarrow R=13$: Start with: $2o - u$; repeat with: $3o - u$; finish with: $2o$.
- (10). $R=13 \rightarrow L=2$: Start with: $o - u$; repeat with: $4o - u$.
- (11). $L=2 \rightarrow R=5$: Start with: $o - u$; repeat with: $o - u - 2o - u$.
- (12). $L=0 \rightarrow R=11$: Start with: $u - o$; repeat with: $u - 2o - 2u - o$.
- (13). $R=11 \rightarrow L=8$: Start with: $u - o$; repeat with: $2u - o$.
- (14). $L=8 \rightarrow R=5$: Start with: u ; repeat with: $2o - u - 2o - 2u$; finish with: o .

$b=7$:

$p = 7n + 4$; hence $r = 4$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=4$: Free Run.
- (2). $R=4 \rightarrow L=8$: Free Run.
- (3). $L=8 \rightarrow R=12$: Free Run.
- (4). $R=12 \rightarrow L=2$: Free Run.
- (5). $L=2 \rightarrow R=6$: Free Run.
- (6). $R=6 \rightarrow L=10$: Free Run.
- (7). $L=10 \rightarrow R=0$: Free Run.
- (8). $R=0 \rightarrow L=4$: Free Run.
- (9). $L=4 \rightarrow R=8$: Start with: u ; repeat with: $3o - u$; finish with: o .
- (10). $R=8 \rightarrow L=12$: Start with: $2o$; repeat with: $u - 4o$.
- (11). $L=12 \rightarrow R=2$: Start with: $u - o$; repeat with: $u - 2o - u - o$.
- (12). $L=0 \rightarrow R=10$: Start with: $2o - u$; repeat with: $o - 2u - 2o - u$.
- (13). $R=10 \rightarrow L=6$: Start and repeat with: $o - 2u$.
- (14). $L=6 \rightarrow R=2$: Start with: $2o - u$; repeat with: $2o - 2u - 2o - u$.

$b=7$:

$p = 7n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=5$: Free Run.
- (2). $R=5 \rightarrow L=10$: Free Run.
- (3). $L=10 \rightarrow R=1$: Free Run.

- (4). $R=1 \rightarrow L=6$: Free Run.
- (5). $L=6 \rightarrow R=11$: Free Run.
- (6). $R=11 \rightarrow L=2$: Free Run.
- (7). $L=2 \rightarrow R=7$: Free Run.
- (8). $R=7 \rightarrow L=12$: Free Run.
- (9). $L=12 \rightarrow R=3$: Start with: $2o$; repeat with: $u - 3o$.
- (10). $R=3 \rightarrow L=8$: Start and repeat with: $u - 4o$; finish with: $u - 2o$.
- (11). $L=8 \rightarrow R=13$: Start with: $u - 2o$; repeat with: $u - o - u - 2o$.
- (12). $L=0 \rightarrow R=9$: Start and repeat with: $o - u$.
- (13). $R=9 \rightarrow L=4$: Start with: $o - u - o - u$; repeat with: $2u - o - u - o - u$;
- (14). $L=4 \rightarrow R=13$: Start with: $o - u - o - u$;
repeat with $2o - u - o - u - o - u$.

$b=7$:

$p = 7n + 6$; hence $r = 6$. For 3-row algorithm-diagram see pg. 34.

Place string-length position $\frac{11}{14}l$ at left bight-boundary position 0. Braid first 11 half-cycles upwards; braid the half-cycles 12, 13 and 14 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=6$: Free Run.
- (2). $R=6 \rightarrow L=12$: Free Run.
- (3). $L=12 \rightarrow R=4$: Free Run.
- (4). $R=4 \rightarrow L=10$: Free Run.
- (5). $L=10 \rightarrow R=2$: Free Run.
- (6). $R=2 \rightarrow L=8$: Free Run.
- (7). $L=8 \rightarrow R=0$: Free Run.
- (8). $R=0 \rightarrow L=6$: Free Run.
- (9). $L=6 \rightarrow R=12$: Start with: $2o - u$; repeat with: $3o - u$.
- (10). $R=12 \rightarrow L=4$: Start with: $3o - u$; repeat with: $4o - u$.
- (11). $L=4 \rightarrow R=10$: Start with: $2o - 2u$; repeat with: $3o - 2u$.
- (12). $L=0 \rightarrow R=8$: Start with: $2u - 3o$; repeat with: $3u - 3o$.
- (13). $R=10 \rightarrow L=2$: Start with: $3u - 2o$; repeat with: $4u - 2o$.
- (14). $L=6 \rightarrow R=10$: Start with: $2u$; repeat with $4o - 3u$; finish with: $3o$.

$b=8$:

$p = 8n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 35.

Place string-length position $\frac{13}{16}l$ at left bight-boundary position 0. Braid first 13 half-cycles upwards; braid the half-cycles 14, 15 and 16 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=1$: Free Run.
- (2). $R=1 \rightarrow L=2$: Free Run.
- (3). $L=2 \rightarrow R=3$: Free Run.
- (4). $R=3 \rightarrow L=4$: Free Run.
- (5). $L=4 \rightarrow R=5$: Free Run.
- (6). $R=5 \rightarrow L=6$: Free Run.
- (7). $L=6 \rightarrow R=7$: Free Run.
- (8). $R=7 \rightarrow L=8$: Free Run.
- (9). $L=8 \rightarrow R=9$: Free Run.
- (10). $R=9 \rightarrow L=10$: Start and repeat with: $u - 4o$.

- (11). $L=10 \longrightarrow R=11$: Start and repeat with: $u - 4o$.
- (12). $R=11 \longrightarrow L=12$: Start and repeat with: $2u - 4o$.
- (13). $L=12 \longrightarrow R=13$: Start and repeat with: $2u - 4o$.
- (14). $L=0 \longrightarrow R=15$: Start and repeat with: $3o - 4u$.
- (15). $R=15 \longrightarrow L=14$: Start and repeat with: $3o - 4u$.
- (16). $L=14 \longrightarrow R=13$: Start and repeat with: $4o - 4u$.

$b=8$:

$p = 8n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg. 35.

Place string-length position $\frac{13}{16}l$ at the left bight-boundary position 0. Braid first 13 half-cycles upwards; then braid the half-cycles 14, 15 and 16 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=3$: Free Run.
- (2). $R=3 \longrightarrow L=6$: Free Run.
- (3). $L=6 \longrightarrow R=9$: Free Run.
- (4). $R=9 \longrightarrow L=12$: Free Run.
- (5). $L=12 \longrightarrow R=15$: Free Run.
- (6). $R=15 \longrightarrow L=2$: Free Run.
- (7). $L=2 \longrightarrow R=5$: Free Run.
- (8). $R=5 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=11$: Free Run.
- (10). $R=11 \longrightarrow L=14$: Start with: o ; repeat with: $u - 4o$.
- (11). $L=14 \longrightarrow R=1$: Start with: o ; repeat with: $u - 4o$.
- (12). $R=1 \longrightarrow L=4$: Start with: $u - o$; repeat with: $u - 3o - u - o$.
- (13). $L=4 \longrightarrow R=7$: Start with: $u - o$; repeat with: $u - 3o - u - o$.
- (14). $L=0 \longrightarrow R=13$: Start with: $o - u$; repeat with: $o - u - o - 2u - o - u$.
- (15). $R=13 \longrightarrow L=10$: Start with: $o - u$; repeat with: $o - u - o - 2u - o - u$.
- (16). $L=10 \longrightarrow R=7$: Start with: $o - u$; repeat with: $2o - u - o - 2u - o - u$.

$b=8$:

$p = 8n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 35.

Place string-length position $\frac{13}{16}l$ at the left bight-boundary position 0. Braid first 13 half-cycles upwards; then braid the half-cycles 14, 15 and 16 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=5$: Free Run.
- (2). $R=5 \longrightarrow L=10$: Free Run.
- (3). $L=10 \longrightarrow R=15$: Free Run.
- (4). $R=15 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=9$: Free Run.
- (6). $R=9 \longrightarrow L=14$: Free Run.
- (7). $L=14 \longrightarrow R=3$: Free Run.
- (8). $R=3 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=13$: Free Run.
- (10). $R=13 \longrightarrow L=2$: Start with: $2o - u$; repeat with: $4o - u$.
- (11). $L=2 \longrightarrow R=7$: Start with: $2o - u$; repeat with: $4o - u$.
- (12). $R=7 \longrightarrow L=12$: Start with: $2o - u$; repeat with: $o - u - 3o - u$.
- (13). $L=12 \longrightarrow R=1$: Start with: $2o - u$; repeat with: $o - u - 3o - u$.

- (14). $L=0 \longrightarrow R=11$: Start with: $u - o - u - o$;
repeat with: $u - o - 2u - o - u - o$.
 (15). $R=11 \longrightarrow L=6$: Start with: $u - o - u - o$; repeat with: $u - o - 2u - o - u - o$.
 (16). $L=6 \longrightarrow R=1$: Start with: $u - o - u$; repeat with: $2o - u - o - 2u - o - u$;
finish with: o .

b=8:

$p = 8n + 7$; hence $r = 7$. For 3-row algorithm-diagram see pg. 35.

Place string-length position $\frac{13}{16}l$ at the left bight-boundary position 0. Braid first 13 half-cycles upwards; then braid the half-cycles 14, 15 and 16 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=7$: Free Run.
- (2). $R=7 \longrightarrow L=14$: Free Run.
- (3). $L=14 \longrightarrow R=5$: Free Run.
- (4). $R=5 \longrightarrow L=12$: Free Run.
- (5). $L=12 \longrightarrow R=3$: Free Run.
- (6). $R=3 \longrightarrow L=10$: Free Run.
- (7). $L=10 \longrightarrow R=1$: Free Run.
- (8). $R=1 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=15$: Free Run.
- (10). $R=15 \longrightarrow L=6$: Start with: $3o - u$; repeat with: $4o - u$.
- (11). $L=6 \longrightarrow R=13$: Start with: $3o - u$; repeat with: $4o - u$.
- (12). $R=13 \longrightarrow L=4$: Start with: $3o - 2u$; repeat with: $4o - 2u$.
- (13). $L=4 \longrightarrow R=11$: Start with: $3o - 2u$; repeat with: $4o - 2u$.
- (14). $L=0 \longrightarrow R=9$: Start with: $3u - 3o$; repeat with: $4u - 3o$.
- (15). $R=9 \longrightarrow L=2$: Start with: $3u - 3o$; repeat with: $4u - 3o$.
- (16). $L=2 \longrightarrow R=11$: Start with: $3u$; repeat with: $4o - 4u$; finish with: $3o$.

b=9:

$p = 9n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 36.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=6$: Free Run.
- (7). $L=6 \longrightarrow R=7$: Free Run.
- (8). $R=7 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=9$: Free Run.
- (10). $R=9 \longrightarrow L=10$: Free Run.
- (11). $L=10 \longrightarrow R=11$: Start and repeat with: $u - 4o$.
- (12). $R=11 \longrightarrow L=12$: Start and repeat with: $u - 5o$.
- (13). $L=12 \longrightarrow R=13$: Start and repeat with: $2u - 4o$.
- (14). $R=13 \longrightarrow L=14$: Start and repeat with: $2u - 5o$.
- (15). $L=0 \longrightarrow R=17$: Start and repeat with: $3o - 4u$.

- (16). $R=17 \longrightarrow L=16$: Start and repeat with: $3o - 5u$.
 (17). $L=16 \longrightarrow R=15$: Start and repeat with: $4o - 4u$.
 (18). $R=15 \longrightarrow L=14$: Start and repeat with: $4o - 5u$.

$b=9$:

$p = 9n + 2$; hence $r = 2$. For 3-row algorithm-diagram see pg. 36.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=2$: Free Run.
- (2). $R=2 \longrightarrow L=4$: Free Run.
- (3). $L=4 \longrightarrow R=6$: Free Run.
- (4). $R=6 \longrightarrow L=8$: Free Run.
- (5). $L=8 \longrightarrow R=10$: Free Run.
- (6). $R=10 \longrightarrow L=12$: Free Run.
- (7). $L=12 \longrightarrow R=14$: Free Run.
- (8). $R=14 \longrightarrow L=16$: Free Run.
- (9). $L=16 \longrightarrow R=0$: Free Run.
- (10). $R=0 \longrightarrow L=2$: Free Run.
- (11). $L=2 \longrightarrow R=4$: Start with: u ; repeat with: $4o - u$.
- (12). $R=4 \longrightarrow L=6$: Start with: $4o - u$; repeat with: $5o - u$; finish with: $2o$.
- (13). $L=6 \longrightarrow R=8$: Start with: u ; repeat with: $3o - u - o - u$.
- (14). $R=8 \longrightarrow L=10$: Start with: $3o - u - o - u$; repeat with: $4o - u - o - u$; finish with: $2o$.
- (15). $L=0 \longrightarrow R=16$: Start and repeat with: $o - 2u - o - u - o - u$; finish with: o .
- (16). $R=16 \longrightarrow L=14$: Start with: $2u - o - u - o - u - o$; repeat with: $3u - o - u - o - u - o$; finish with: $2u$.
- (17). $L=14 \longrightarrow R=12$: Start with: o ; repeat with: $u - o$.
- (18). $R=12 \longrightarrow L=10$: Start with: u ; repeat with: $o - u - o - u - o - u - o - 2u$.

$b=9$:

$p = 9n + 4$; hence $r = 4$. For 3-row algorithm-diagram see pg. 36.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=4$: Free Run.
- (2). $R=4 \longrightarrow L=8$: Free Run.
- (3). $L=8 \longrightarrow R=12$: Free Run.
- (4). $R=12 \longrightarrow L=16$: Free Run.
- (5). $L=16 \longrightarrow R=2$: Free Run.
- (6). $R=2 \longrightarrow L=6$: Free Run.
- (7). $L=6 \longrightarrow R=10$: Free Run.
- (8). $R=10 \longrightarrow L=14$: Free Run.
- (9). $L=14 \longrightarrow R=0$: Free Run.
- (10). $R=0 \longrightarrow L=4$: Free Run.
- (11). $L=4 \longrightarrow R=8$: Start with: $o - u$; repeat with: $4o - u$.
- (12). $R=8 \longrightarrow L=12$: Start with: $4o - u$; repeat with: $5o - u$; finish with: $3o$.
- (13). $L=12 \longrightarrow R=16$: Start with: $o - u$; repeat with: $2o - u$.

- (14). $R=16 \longrightarrow L=2$: Start with: $2o - u$; repeat with: $2o - u - 3o - u$.
 (15). $L=0 \longrightarrow R=14$: Start with: $u - 2o$; repeat with: $2u - o - 2u - 2o$.
 (16). $R=14 \longrightarrow L=10$: Start with: $2u - o$; repeat with: $2u - 2o - 3u - o$.
 (17). $L=10 \longrightarrow R=6$: Start with: $u - 2o$; repeat with: $2u - 2o$.
 (18). $R=6 \longrightarrow L=2$: Start with: $2u$; repeat with: $2o - 2u - 2o - 3u$;
 finish with: o .

$b=9$:

$p = 9n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 36.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=5$: Free Run.
 (2). $R=5 \longrightarrow L=10$: Free Run.
 (3). $L=10 \longrightarrow R=15$: Free Run.
 (4). $R=15 \longrightarrow L=2$: Free Run.
 (5). $L=2 \longrightarrow R=7$: Free Run.
 (6). $R=7 \longrightarrow L=12$: Free Run.
 (7). $L=12 \longrightarrow R=17$: Free Run.
 (8). $R=17 \longrightarrow L=4$: Free Run.
 (9). $L=4 \longrightarrow R=9$: Free Run.
 (10). $R=9 \longrightarrow L=14$: Free Run.
 (11). $L=14 \longrightarrow R=1$: Start with: $2o$; repeat with: $u - 4o$.
 (12). $R=1 \longrightarrow L=6$: Start and repeat with: $u - 5o$; finish with: $u - 2o$.
 (13). $L=6 \longrightarrow R=11$: Start and repeat with: $u - 2o$.
 (14). $R=11 \longrightarrow L=16$: Start with: $u - 2o$; repeat with: $u - 3o - u - 2o$.
 (15). $L=0 \longrightarrow R=13$: Start with: $o - 2u$; repeat with: $2o - 2u - o - 2u$.
 (16). $R=13 \longrightarrow L=8$: Start with: $2o - 2u$; repeat with: $o - 3u - 2o - 2u$.
 (17). $L=8 \longrightarrow R=3$: Start and repeat with: $2o - 2u$.
 (18). $R=3 \longrightarrow L=16$: Start with: $2o - 2u$; repeat with: $2o - 3u - 2o - 2u$.

$b=9$:

$p = 9n + 7$; hence $r = 7$. For 3-row algorithm-diagram see pg. 37.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=7$: Free Run.
 (2). $R=7 \longrightarrow L=14$: Free Run.
 (3). $L=14 \longrightarrow R=3$: Free Run.
 (4). $R=3 \longrightarrow L=10$: Free Run.
 (5). $L=10 \longrightarrow R=17$: Free Run.
 (6). $R=17 \longrightarrow L=6$: Free Run.
 (7). $L=6 \longrightarrow R=13$: Free Run.
 (8). $R=13 \longrightarrow L=2$: Free Run.
 (9). $L=2 \longrightarrow R=9$: Free Run.
 (10). $R=9 \longrightarrow L=16$: Free Run.
 (11). $L=16 \longrightarrow R=5$: Start with: $3o$; repeat with: $u - 4o$.
 (12). $R=5 \longrightarrow L=12$: Start and repeat with: $u - 5o$; finish with: $u - 3o$.

- (13). $L=12 \rightarrow R=1$: Start with: $u - 3o$; repeat with: $u - o - u - 3o$.
 (14). $R=1 \rightarrow L=8$: Start and repeat with: $u - o - u - 4o$;
 finish with: $u - o - u - 2o$.
 (15). $L=0 \rightarrow R=11$: Start with: $o - u - o - 2u$;
 repeat with: $o - u - o - u - o - 2u$.
 (16). $R=11 \rightarrow L=4$: Start and repeat with: $o - u - o - u - o - 3u$;
 finish with: $o - u - o - u - o - u$.
 (17). $L=4 \rightarrow R=15$: Start and repeat with: $o - u$.
 (18). $R=15 \rightarrow L=8$: Start with: $o - u - o - u - o - u$;
 repeat with: $o - 2u - o - u - o - u - o - u$.

$b=9$:

$p = 9n + 8$; hence $r = 8$. For 3-row algorithm-diagram see pg. 37.

Place string-length position $\frac{7}{9}l$ at the left bight-boundary position 0. Braid first 14 half-cycles upwards; then braid the half-cycles 15, 16, 17 and 18 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=8$: Free Run.
 (2). $R=8 \rightarrow L=16$: Free Run.
 (3). $L=16 \rightarrow R=6$: Free Run.
 (4). $R=6 \rightarrow L=14$: Free Run.
 (5). $L=14 \rightarrow R=4$: Free Run.
 (6). $R=4 \rightarrow L=12$: Free Run.
 (7). $L=12 \rightarrow R=2$: Free Run.
 (8). $R=2 \rightarrow L=10$: Free Run.
 (9). $L=10 \rightarrow R=0$: Free Run.
 (10). $R=0 \rightarrow L=8$: Free Run.
 (11). $L=8 \rightarrow R=16$: Start with: $3o - u$; repeat with: $4o - u$.
 (12). $R=16 \rightarrow L=6$: Start with: $4o - u$; repeat with: $5o - u$.
 (13). $L=6 \rightarrow R=14$: Start with: $3o - 2u$; repeat with: $4o - 2u$.
 (14). $R=14 \rightarrow L=4$: Start with: $4o - 2u$; repeat with: $5o - 2u$.
 (15). $L=0 \rightarrow R=10$: Start with: $3u - 3o$; repeat with: $4u - 3o$.
 (16). $R=10 \rightarrow L=2$: Start with: $4u - 3o$; repeat with: $5u - 3o$.
 (17). $L=2 \rightarrow R=12$: Start with: $3u - 4o$; repeat with: $4u - 4o$.
 (18). $R=12 \rightarrow L=4$: Start with: $4u$; repeat with: $4o - 5u$; finish with: $3o$.

$b=10$:

$p = 10n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 37.

Place string-length position $\frac{4}{5}l$ at the left bight-boundary position 0. Braid first 16 half-cycles upwards; then braid the half-cycles 17, 18, 19 and 20 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=1$: Free Run.
 (2). $R=1 \rightarrow L=2$: Free Run.
 (3). $L=2 \rightarrow R=3$: Free Run.
 (4). $R=3 \rightarrow L=4$: Free Run.
 (5). $L=4 \rightarrow R=5$: Free Run.
 (6). $R=5 \rightarrow L=6$: Free Run.
 (7). $L=6 \rightarrow R=7$: Free Run.
 (8). $R=7 \rightarrow L=8$: Free Run.

- (9). $L=8 \longrightarrow R=9$: Free Run.
- (10). $R=9 \longrightarrow L=10$: Free Run.
- (11). $L=10 \longrightarrow R=11$: Free Run.
- (12). $R=11 \longrightarrow L=12$: Start and repeat with: $u - 5o$.
- (13). $L=12 \longrightarrow R=13$: Start and repeat with: $u - 5o$.
- (14). $R=13 \longrightarrow L=14$: Start and repeat with: $2u - 5o$.
- (15). $L=14 \longrightarrow R=15$: Start and repeat with: $2u - 5o$.
- (16). $R=15 \longrightarrow L=16$: Start and repeat with: $3u - 5o$.
- (17). $L=0 \longrightarrow R=19$: Start and repeat with: $3o - 5u$.
- (18). $R=19 \longrightarrow L=18$: Start and repeat with: $4o - 5u$.
- (19). $L=18 \longrightarrow R=17$: Start and repeat with: $4o - 5u$.
- (20). $R=17 \longrightarrow L=16$: Start and repeat with: $5o - 5u$.

$b=10$:

$p = 10n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg. 37.

Place string-length position $\frac{4}{5}l$ at the left bight-boundary position 0. Braid first 16 half-cycles upwards; then braid the half-cycles 17, 18, 19 and 20 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=3$: Free Run.
- (2). $R=3 \longrightarrow L=6$: Free Run.
- (3). $L=6 \longrightarrow R=9$: Free Run.
- (4). $R=9 \longrightarrow L=12$: Free Run.
- (5). $L=12 \longrightarrow R=15$: Free Run.
- (6). $R=15 \longrightarrow L=18$: Free Run.
- (7). $L=18 \longrightarrow R=1$: Free Run.
- (8). $R=1 \longrightarrow L=4$: Free Run.
- (9). $L=4 \longrightarrow R=7$: Free Run.
- (10). $R=7 \longrightarrow L=10$: Free Run.
- (11). $L=10 \longrightarrow R=13$: Free Run.
- (12). $R=13 \longrightarrow L=16$: Start with: $2o - u$; repeat with: $5o - u$; finish with: $4o$.
- (13). $L=16 \longrightarrow R=19$: Start with: $2o - u$; repeat with: $5o - u$; finish with: $4o$.
- (14). $R=19 \longrightarrow L=2$: Start with: $o - u$; repeat with: $o - u - 4o - u$.
- (15). $L=2 \longrightarrow R=5$: Start with: $o - u$; repeat with: $o - u - 4o - u$.
- (16). $R=5 \longrightarrow L=8$: Start with: $o - u$; repeat with: $o - u - 2o - u - 2o - u$.
- (17). $L=0 \longrightarrow R=17$: Start with: $u - o$; repeat with: $u - o - 2u - o - 2u - o$.
- (18). $R=17 \longrightarrow L=14$: Start with: $u - o$; repeat with: $u - 2o - 2u - o - 2u - o$.
- (19). $L=14 \longrightarrow R=11$: Start with: $u - o$; repeat with: $u - 2o - 2u - o - 2u - o$.
- (20). $R=11 \longrightarrow L=8$: Start with: u ; repeat with: $2o - u - 2o - 2u - o - 2u$; finish with o .

$b=10$:

$p = 10n + 7$; hence $r = 7$. For 3-row algorithm-diagram see pg. 38.

Place string-length position $\frac{4}{5}l$ at the left bight-boundary position 0. Braid first 16 half-cycles upwards; then braid the half-cycles 17, 18, 19 and 20 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=7$: Free Run.
- (2). $R=7 \longrightarrow L=14$: Free Run.
- (3). $L=14 \longrightarrow R=1$: Free Run.

- (4). $R=1 \rightarrow L=8$: Free Run.
- (5). $L=8 \rightarrow R=15$: Free Run.
- (6). $R=15 \rightarrow L=2$: Free Run.
- (7). $L=2 \rightarrow R=9$: Free Run.
- (8). $R=9 \rightarrow L=16$: Free Run.
- (9). $L=16 \rightarrow R=3$: Free Run.
- (10). $R=3 \rightarrow L=10$: Free Run.
- (11). $L=10 \rightarrow R=17$: Free Run.
- (12). $R=17 \rightarrow L=4$: Start with: $2o - u$; repeat with: $5o - u$; finish with: o .
- (13). $L=4 \rightarrow R=11$: Start with: $2o - u$; repeat with: $5o - u$; finish with: o .
- (14). $R=11 \rightarrow L=18$: Start with: $2o - u - o$; repeat with: $u - 4o - u - o$.
- (15). $L=18 \rightarrow R=5$: Start with: $2o - u - o$; repeat with: $u - 4o - u - o$.
- (16). $R=5 \rightarrow L=12$: Start with: $u - 2o - u - o$;
repeat with: $u - 2o - u - 2o - u - o$.
- (17). $L=0 \rightarrow R=13$: Start with: $o - 2u - o - u$;
repeat with: $o - 2u - o - 2u - o - u$.
- (18). $R=13 \rightarrow L=6$: Start with: $o - 2u - 2o - u$;
repeat with: $o - 2u - o - 2u - 2o - u$.
- (19). $L=16 \rightarrow R=19$: Start with: $o - 2u - 2o - u$;
repeat with: $o - 2u - o - 2u - 2o - u$.
- (20). $R=19 \rightarrow L=12$: Start with: $o - 2u - 2o - u$;
repeat with: $2o - 2u - o - 2u - 2o - u$.

$b=10$:

$p = 10n + 9$; hence $r = 9$. For 3-row algorithm-diagram see pg. 38.

Place string-length position $\frac{4}{5}l$ at the left bight-boundary position 0. Braid first 16 half-cycles upwards; then braid the half-cycles 17, 18, 19 and 20 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=9$: Free Run.
- (2). $R=9 \rightarrow L=18$: Free Run.
- (3). $L=18 \rightarrow R=7$: Free Run.
- (4). $R=7 \rightarrow L=16$: Free Run.
- (5). $L=16 \rightarrow R=5$: Free Run.
- (6). $R=5 \rightarrow L=14$: Free Run.
- (7). $L=14 \rightarrow R=3$: Free Run.
- (8). $R=3 \rightarrow L=12$: Free Run.
- (9). $L=12 \rightarrow R=1$: Free Run.
- (10). $R=1 \rightarrow L=10$: Free Run.
- (11). $L=10 \rightarrow R=19$: Free Run.
- (12). $R=19 \rightarrow L=8$: Start with: $4o - u$; repeat with: $5o - u$.
- (13). $L=8 \rightarrow R=17$: Start with: $4o - u$; repeat with: $5o - u$.
- (14). $R=17 \rightarrow L=6$: Start with: $4o - 2u$; repeat with: $5o - 2u$.
- (15). $L=6 \rightarrow R=15$: Start with: $4o - 2u$; repeat with: $5o - 2u$.
- (16). $R=15 \rightarrow L=4$: Start with: $4o - 3u$; repeat with: $5o - 3u$.
- (17). $L=0 \rightarrow R=11$: Start with: $4u - 3o$; repeat with: $5u - 3o$.
- (18). $R=11 \rightarrow L=2$: Start with: $4u - 4o$; repeat with: $5u - 4o$.
- (19). $L=2 \rightarrow R=13$: Start with: $4u - 4o$; repeat with: $5u - 4o$.
- (20). $R=13 \rightarrow L=4$: Start with: $4u$; repeat with: $5o - 5u$; finish with: $4o$.

$b=11$:

$p = 11n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 38.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=6$: Free Run.
- (7). $L=6 \longrightarrow R=7$: Free Run.
- (8). $R=7 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=9$: Free Run.
- (10). $R=9 \longrightarrow L=10$: Free Run.
- (11). $L=10 \longrightarrow R=11$: Free Run.
- (12). $R=11 \longrightarrow L=12$: Free Run.
- (13). $L=12 \longrightarrow R=13$: Start and repeat with: $u - 5o$.
- (14). $R=13 \longrightarrow L=14$: Start and repeat with: $u - 6o$.
- (15). $L=14 \longrightarrow R=15$: Start and repeat with: $2u - 5o$.
- (16). $R=15 \longrightarrow L=16$: Start and repeat with: $2u - 6o$.
- (17). $L=16 \longrightarrow R=17$: Start and repeat with: $3u - 5o$.
- (18). $L=0 \longrightarrow R=21$: Start and repeat with: $4o - 5u$.
- (19). $R=21 \longrightarrow L=20$: Start and repeat with: $3o - 6u$.
- (20). $L=20 \longrightarrow R=19$: Start and repeat with: $5o - 5u$.
- (21). $R=19 \longrightarrow L=18$: Start and repeat with: $4o - 6u$.
- (22). $L=18 \longrightarrow R=17$: Start and repeat with: $6o - 5u$.

$b=11$:

$p = 11n + 2$; hence $r = 2$. For 3-row algorithm-diagram see pg. 38.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=2$: Free Run.
- (2). $R=2 \longrightarrow L=4$: Free Run.
- (3). $L=4 \longrightarrow R=6$: Free Run.
- (4). $R=6 \longrightarrow L=8$: Free Run.
- (5). $L=8 \longrightarrow R=10$: Free Run.
- (6). $R=10 \longrightarrow L=12$: Free Run.
- (7). $L=12 \longrightarrow R=14$: Free Run.
- (8). $R=14 \longrightarrow L=16$: Free Run.
- (9). $L=16 \longrightarrow R=18$: Free Run.
- (10). $R=18 \longrightarrow L=20$: Free Run.
- (11). $L=20 \longrightarrow R=0$: Free Run.
- (12). $R=0 \longrightarrow L=2$: Free Run.
- (13). $L=2 \longrightarrow R=4$: Start with: u ; repeat with: $5o - u$.
- (14). $R=4 \longrightarrow L=6$: Start with: $5o - u$; repeat with: $6o - u$; finish with: $2o$.
- (15). $L=6 \longrightarrow R=8$: Start with: u ; repeat with: $4o - u - o - u$.

- (16). $R=8 \longrightarrow L=10$: Start with: $4o - u - o - u$; repeat with: $5o - u - o - u$; finish with: $2o$.
- (17). $L=10 \longrightarrow R=12$: Start with: u ; repeat with: $3o - u - o - u - o - u$.
- (18). $L=0 \longrightarrow R=20$: Start with: o ; repeat with: $2u - o - u - o - u - o - u - o$.
- (19). $R=20 \longrightarrow L=18$: Start with: $3u - o - u - o - u - o$; repeat with: $4u - o - u - o - u - o$; finish with: $2u$.
- (20). $L=18 \longrightarrow R=16$: Start with: o ; repeat with: $u - o$.
- (21). $R=16 \longrightarrow L=14$: Start with: $2u - o - u - o - u - o - u - o$; repeat with: $3u - o - u - o - u - o - u - o$; finish with: $2u$.
- (22). $L=14 \longrightarrow R=12$: Start and repeat with: $2o - u - o - u - o - u - o - u - o - u$; finish with: o .

$b=11$:

$p = 11n + 3$; hence $r = 3$. For 3-row algorithm-diagram see pg. 39.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=3$: Free Run.
- (2). $R=3 \longrightarrow L=6$: Free Run.
- (3). $L=6 \longrightarrow R=9$: Free Run.
- (4). $R=9 \longrightarrow L=12$: Free Run.
- (5). $L=12 \longrightarrow R=15$: Free Run.
- (6). $R=15 \longrightarrow L=18$: Free Run.
- (7). $L=18 \longrightarrow R=21$: Free Run.
- (8). $R=21 \longrightarrow L=2$: Free Run.
- (9). $L=2 \longrightarrow R=5$: Free Run.
- (10). $R=5 \longrightarrow L=8$: Free Run.
- (11). $L=8 \longrightarrow R=11$: Free Run.
- (12). $R=11 \longrightarrow L=14$: Free Run.
- (13). $L=14 \longrightarrow R=17$: Start with: $2o - u$; repeat with: $5o - u$; finish with: $4o$.
- (14). $R=17 \longrightarrow L=20$: Start with: o ; repeat with: $u - 6o$.
- (15). $L=20 \longrightarrow R=1$: Start with: o ; repeat with: $u - o - u - 4o$.
- (16). $R=1 \longrightarrow L=4$: Start with: $u - o$; repeat with: $u - 5o - u - o$.
- (17). $L=4 \longrightarrow R=7$: Start with: $u - o$; repeat with: $u - o - u - 3o - u - o$.
- (18). $L=0 \longrightarrow R=19$: Start with: $o - u$; repeat with: $o - u - o - u - o - 2u - o - u$.
- (19). $R=19 \longrightarrow L=16$: Start with: $o - u$; repeat with: $o - 3u - o - 2u - o - u$.
- (20). $L=16 \longrightarrow R=13$: Start with: $o - u$; repeat with: $o - u - 2o - u - o - 2u - o - u$.
- (21). $R=13 \longrightarrow L=10$: Start with: $o - u$; repeat with: $o - u - o - 2u - o - 2u - o - u$.
- (22). $L=10 \longrightarrow R=7$: Start with: $o - u$; repeat with: $2o - u - 2o - u - o - 2u - o - u$.

$b=11$:

$p = 11n + 4$; hence $r = 4$. For 3-row algorithm-diagram see pg. 39.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=4$: Free Run.
- (2). $R=4 \rightarrow L=8$: Free Run.
- (3). $L=8 \rightarrow R=12$: Free Run.
- (4). $R=12 \rightarrow L=16$: Free Run.
- (5). $L=16 \rightarrow R=20$: Free Run.
- (6). $R=20 \rightarrow L=2$: Free Run.
- (7). $L=2 \rightarrow R=6$: Free Run.
- (8). $R=6 \rightarrow L=10$: Free Run.
- (9). $L=10 \rightarrow R=14$: Free Run.
- (10). $R=14 \rightarrow L=18$: Free Run.
- (11). $L=18 \rightarrow R=0$: Free Run.
- (12). $R=0 \rightarrow L=4$: Free Run.
- (13). $L=4 \rightarrow R=8$: Start and repeat with: $u - 5o$; finish with: $u - o$.
- (14). $R=8 \rightarrow L=12$: Start with: $4o - u$; repeat with: $6o - u$; finish with: $4o$.
- (15). $L=12 \rightarrow R=16$: Start and repeat with: $u - 3o - u - 2o$; finish with: $u - o$.
- (16). $R=16 \rightarrow L=20$: Start with: $2o$; repeat with: $u - 2o - u - 4o$.
- (17). $L=20 \rightarrow R=2$: Start and repeat with: $u - o - u - 2o - u - 2o$;
finish with: $u - o$.
- (18). $L=0 \rightarrow R=18$: Start with: $2o - u$; repeat with: $o - 2u - o - 2u - 2o - u$.
- (19). $R=18 \rightarrow L=14$: Start and repeat with: $o - 2u$.
- (20). $L=14 \rightarrow R=10$: Start with: $2o - u$; repeat with: $o - 2u - 2o - 2u - 2o - u$.
- (21). $R=10 \rightarrow L=6$: Start with: $o - 2u$; repeat with: $o - 2u - 2o - 2u - o - 2u$.
- (22). $L=6 \rightarrow R=2$: Start with: $2o - u$; repeat with: $2o - 2u - 2o - 2u - 2o - u$.

$b=11$:

$p = 11n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 39.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are :

- (1). $L=0 \rightarrow R=5$: Free Run.
- (2). $R=5 \rightarrow L=10$: Free Run.
- (3). $L=10 \rightarrow R=15$: Free Run.
- (4). $R=15 \rightarrow L=20$: Free Run.
- (5). $L=20 \rightarrow R=3$: Free Run.
- (6). $R=3 \rightarrow L=8$: Free Run.
- (7). $L=8 \rightarrow R=13$: Free Run.
- (8). $R=13 \rightarrow L=18$: Free Run.
- (9). $L=18 \rightarrow R=1$: Free Run.
- (10). $R=1 \rightarrow L=6$: Free Run.
- (11). $L=6 \rightarrow R=11$: Free Run.
- (12). $R=11 \rightarrow L=16$: Free Run.
- (13). $L=16 \rightarrow R=21$: Start with: $4o - u$; repeat with: $5o - u$; finish with: $3o$.
- (14). $R=21 \rightarrow L=4$: Start with: $2o - u$; repeat with: $6o - u$.
- (15). $L=4 \rightarrow R=9$: Start with: $2o - u$; repeat with: $2o - u - 3o - u$.
- (16). $R=9 \rightarrow L=14$: Start with: $2o - u$; repeat with: $3o - u$.
- (17). $L=14 \rightarrow R=19$: Start with: $2o - u$; repeat with: $2o - 2u - 3o - u$.
- (18). $L=0 \rightarrow R=17$: Start with: $2u - 2o$; repeat with: $2u - 2o - 3u - 2o$.
- (19). $R=17 \rightarrow L=12$: Start with: $2u - 2o$; repeat with: $3u - o - 3u - 2o$.

- (20). $L=12 \rightarrow R=7$: Start with: $2u - 2o$; repeat with: $2u - 3o - 3u - 2o$.
 (21). $R=7 \rightarrow L=2$: Start with: $2u - 2o$; repeat with: $3u - 2o$.
 (22). $L=2 \rightarrow R=19$: Start with: $2u$; repeat with: $3o - 2u - 3o - 3u$;
 finish with: $2o$.

$b=11$:

$p = 11n + 6$; hence $r = 6$. For 3-row algorithm-diagram see pg. 39.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=6$: Free Run.
- (2). $R=6 \rightarrow L=12$: Free Run.
- (3). $L=12 \rightarrow R=18$: Free Run.
- (4). $R=18 \rightarrow L=2$: Free Run.
- (5). $L=2 \rightarrow R=8$: Free Run.
- (6). $R=8 \rightarrow L=14$: Free Run.
- (7). $L=14 \rightarrow R=20$: Free Run.
- (8). $R=20 \rightarrow L=4$: Free Run.
- (9). $L=4 \rightarrow R=10$: Free Run.
- (10). $R=10 \rightarrow L=16$: Free Run.
- (11). $L=16 \rightarrow R=0$: Free Run.
- (12). $R=0 \rightarrow L=6$: Free Run.
- (13). $L=6 \rightarrow R=12$: Start and repeat with: $u - 5o$; finish with: $u - 2o$.
- (14). $R=12 \rightarrow L=18$: Start with: $3o$; repeat with: $u - 6o$.
- (15). $L=18 \rightarrow R=2$: Start with: $u - 2o$; repeat with: $u - 3o - u - 2o$.
- (16). $R=2 \rightarrow L=8$: Start and repeat with: $u - 3o$.
- (17). $L=8 \rightarrow R=14$: Start with: $2u - 2o$; repeat with: $u - 3o - 2u - 2o$.
- (18). $L=0 \rightarrow R=16$: Start with: $2o - 2u$; repeat with: $2o - 3u - 2o - 2u$.
- (19). $R=16 \rightarrow L=10$: Start with: $o - 3u$; repeat with: $2o - 3u - o - 3u$.
- (20). $L=10 \rightarrow R=4$: Start with: $3o - 2u$; repeat with: $2o - 3u - 3o - 2u$.
- (21). $R=4 \rightarrow L=20$: Start and repeat with: $2o - 3u$.
- (22). $L=20 \rightarrow R=14$: Start with: $3o - 2u$; repeat with: $3o - 3u - 3o - 2u$.

$b=11$:

$p = 11n + 7$; hence $r = 7$. For 3-row algorithm-diagram see pg. 40.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=7$: Free Run.
- (2). $R=7 \rightarrow L=14$: Free Run.
- (3). $L=14 \rightarrow R=21$: Free Run.
- (4). $R=21 \rightarrow L=6$: Free Run.
- (5). $L=6 \rightarrow R=13$: Free Run.
- (6). $R=13 \rightarrow L=20$: Free Run.
- (7). $L=20 \rightarrow R=5$: Free Run.
- (8). $R=5 \rightarrow L=12$: Free Run.
- (9). $L=12 \rightarrow R=19$: Free Run.
- (10). $R=19 \rightarrow L=4$: Free Run.

- (11). $L=4 \rightarrow R=11$: Free Run.
 (12). $R=11 \rightarrow L=18$: Free Run.
 (13). $L=18 \rightarrow R=3$: Start with: $4o - u$; repeat with: $5o - u$; finish with: $4o$.
 (14). $R=3 \rightarrow L=10$: Start with: $o - u$; repeat with: $6o - u$; finish with: $2o$.
 (15). $L=10 \rightarrow R=17$: Start with: $o - u$; repeat with: $3o - u - 2o - u$; finish with: $2o$.
 (16). $R=17 \rightarrow L=2$: Start with: $o - u - 2o - u$; repeat with: $4o - u - 2o - u$.
 (17). $L=2 \rightarrow R=9$: Start with: $o - u - 2o - u$; repeat with: $o - u - 2o - u - 2o - u$.
 (18). $L=0 \rightarrow R=15$: Start with: $u - o - 2u - o$; repeat with: $u - 2o - 2u - o - 2u - o$.
 (19). $R=15 \rightarrow L=8$: Start with: $u - o$; repeat with: $2u - o$.
 (20). $L=8 \rightarrow R=1$: Start with: $u - 2o - 2u - o$; repeat with: $u - 2o - 2u - 2o - 2u - o$.
 (21). $R=1 \rightarrow L=16$: Start with: $u - 2o - 2u - o$; repeat with: $2u - o - 2u - 2o - 2u - o$.
 (22). $L=16 \rightarrow R=9$: Start with: $u - 2o - 2u$; repeat with: $2o - u - 2o - 2u - 2o - 2u$; finish with: o .

$b=11$:

$p = 11n + 8$; hence $r = 8$. For 3-row algorithm-diagram see pg. 40.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are :

- (1). $L=0 \rightarrow R=8$: Free Run.
 (2). $R=8 \rightarrow L=16$: Free Run.
 (3). $L=16 \rightarrow R=2$: Free Run.
 (4). $R=2 \rightarrow L=10$: Free Run.
 (5). $L=10 \rightarrow R=18$: Free Run.
 (6). $R=18 \rightarrow L=4$: Free Run.
 (7). $L=4 \rightarrow R=12$: Free Run.
 (8). $R=12 \rightarrow L=20$: Free Run.
 (9). $L=20 \rightarrow R=6$: Free Run.
 (10). $R=6 \rightarrow L=14$: Free Run.
 (11). $L=14 \rightarrow R=0$: Free Run.
 (12). $R=0 \rightarrow L=8$: Free Run.
 (13). $L=8 \rightarrow R=16$: Start with: $2o - u$; repeat with: $5o - u$; finish with: o .
 (14). $R=16 \rightarrow L=2$: Start with: $4o - u$; repeat with: $6o - u$.
 (15). $L=2 \rightarrow R=10$: Start with: $2o - u - o - u$; repeat with: $4o - u - o - u$.
 (16). $R=10 \rightarrow L=18$: Start with: $4o - u$; repeat with: $o - u - 5o - u$.
 (17). $L=18 \rightarrow R=4$: Start with: $2o - u - o - u$; repeat with: $o - u - 3o - u - o - u$.
 (18). $L=0 \rightarrow R=14$: Start with: $u - o - u - o - u - o$; repeat with: $u - o - 2u - o - u - o - u - o$.
 (19). $R=14 \rightarrow L=6$: Start with: $u - o - 3u - o$; repeat with: $u - o - 2u - o - 3u - o$.
 (20). $L=6 \rightarrow R=20$: Start with: $u - o - u - 2o - u - o$; repeat with: $u - o - 2u - o - u - 2o - u - o$.

- (21). $R=20 \longrightarrow L=12$: Start with: $u - o - 2u - o - u - o$;
 repeat with: $u - o - 2u - o - 2u - o - u - o$.
 (22). $L=12 \longrightarrow R=4$: Start with: $u - o - u$;
 repeat with: $2o - u - 2o - u - o - 2u - o - u$;
 finish with: $2o - u - o$.

$b=11$:

$p = 11n + 9$; hence $r = 9$. For 3-row algorithm-diagram see pg. 40.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=9$: Free Run.
- (2). $R=9 \longrightarrow L=18$: Free Run.
- (3). $L=18 \longrightarrow R=5$: Free Run.
- (4). $R=5 \longrightarrow L=14$: Free Run.
- (5). $L=14 \longrightarrow R=1$: Free Run.
- (6). $R=1 \longrightarrow L=10$: Free Run.
- (7). $L=10 \longrightarrow R=19$: Free Run.
- (8). $R=19 \longrightarrow L=6$: Free Run.
- (9). $L=6 \longrightarrow R=15$: Free Run.
- (10). $R=15 \longrightarrow L=2$: Free Run.
- (11). $L=2 \longrightarrow R=11$: Free Run.
- (12). $R=11 \longrightarrow L=20$: Free Run.
- (13). $L=20 \longrightarrow R=7$: Start with: $4o$; repeat with: $u - 5o$.
- (14). $R=7 \longrightarrow L=16$: Start and repeat with: $u - 6o$; finish with: $u - 4o$.
- (15). $L=16 \longrightarrow R=3$: Start with: $u - 4o$; repeat with: $u - o - u - 4o$.
- (16). $R=3 \longrightarrow L=12$: Start and repeat with: $u - o - u - 5o$;
 finish with: $u - o - u - 3o$.
- (17). $L=12 \longrightarrow R=21$: Start with: $u - o - u - 3o$;
 repeat with: $u - o - u - o - u - 3o$.
- (18). $L=0 \longrightarrow R=13$: Start with: $o - u - o - u - o - 2u$;
 repeat with: $o - u - o - u - o - u - o - 2u$.
- (19). $R=13 \longrightarrow L=4$: Start and repeat with: $o - u - o - u - o - 4u$;
 finish with: $o - u - o - u - o - 2u$.
- (20). $L=4 \longrightarrow R=17$: Start and repeat with: $o - u$.
- (21). $R=17 \longrightarrow L=8$: Start and repeat with: $o - u - o - u - o - u - o - 3u$;
 finish with: $o - u - o - u - o - u - o - u$.
- (22). $L=8 \longrightarrow R=21$: Start with: $o - u - o - u - o - u - o - u$;
 repeat with: $2o - u - o - u - o - u - o - u - o - u$.

$b=11$:

$p = 11n + 10$; hence $r = 10$. For 3-row algorithm-diagram see pg. 40.

Place string-length position $\frac{17}{22}l$ at the left bight-boundary position 0. Braid first 17 half-cycles upwards; then braid the half-cycles 18, 19, 20, 21 and 22 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \longrightarrow R=10$: Free Run.
- (2). $R=10 \longrightarrow L=20$: Free Run.
- (3). $L=20 \longrightarrow R=8$: Free Run.

- (4). $R=8 \longrightarrow L=18$: Free Run.
- (5). $L=18 \longrightarrow R=6$: Free Run.
- (6). $R=6 \longrightarrow L=16$: Free Run.
- (7). $L=16 \longrightarrow R=4$: Free Run.
- (8). $R=4 \longrightarrow L=14$: Free Run.
- (9). $L=14 \longrightarrow R=2$: Free Run.
- (10). $R=2 \longrightarrow L=12$: Free Run.
- (11). $L=12 \longrightarrow R=0$: Free Run.
- (12). $R=0 \longrightarrow L=10$: Free Run.
- (13). $L=10 \longrightarrow R=20$: Start with: $4o - u$; repeat with: $5o - u$.
- (14). $R=20 \longrightarrow L=8$: Start with: $5o - u$; repeat with: $6o - u$.
- (15). $L=8 \longrightarrow R=18$: Start with: $4o - 2u$; repeat with: $5o - 2u$.
- (16). $R=18 \longrightarrow L=6$: Start with: $5o - 2u$; repeat with: $6o - 2u$.
- (17). $L=6 \longrightarrow R=16$: Start with: $4o - 3u$; repeat with: $5o - 3u$.
- (18). $L=0 \longrightarrow R=12$: Start with: $4u - 4o$; repeat with: $5u - 4o$.
- (19). $R=12 \longrightarrow L=2$: Start with: $5u - 3o$; repeat with: $6u - 3o$.
- (20). $L=2 \longrightarrow R=14$: Start with: $4u - 5o$; repeat with: $5u - 5o$.
- (21). $R=14 \longrightarrow L=4$: Start with: $5u - 4o$; repeat with: $6u - 4o$.
- (22). $L=4 \longrightarrow R=16$: Start with: $4u$; repeat with: $6o - 5u$; finish with: $5o$.

$b=12$:

$p = 12n + 1$; hence $r = 1$. For 3-row algorithm-diagram see pg. 41.

Place string-length position $\frac{19}{24}l$ at the left bight-boundary position 0. Braid first 19 half-cycles upwards; then braid the half-cycles 20, 21, 22, 23 and 24 downwards.

The half-cycle algorithms for this knot are :

- (1). $L=0 \longrightarrow R=1$: Free Run.
- (2). $R=1 \longrightarrow L=2$: Free Run.
- (3). $L=2 \longrightarrow R=3$: Free Run.
- (4). $R=3 \longrightarrow L=4$: Free Run.
- (5). $L=4 \longrightarrow R=5$: Free Run.
- (6). $R=5 \longrightarrow L=6$: Free Run.
- (7). $L=6 \longrightarrow R=7$: Free Run.
- (8). $R=7 \longrightarrow L=8$: Free Run.
- (9). $L=8 \longrightarrow R=9$: Free Run.
- (10). $R=9 \longrightarrow L=10$: Free Run.
- (11). $L=10 \longrightarrow R=11$: Free Run.
- (12). $R=11 \longrightarrow L=12$: Free Run.
- (13). $L=12 \longrightarrow R=13$: Free Run.
- (14). $R=13 \longrightarrow L=14$: Start and repeat with: $u - 6o$.
- (15). $L=14 \longrightarrow R=15$: Start and repeat with: $u - 6o$.
- (16). $R=15 \longrightarrow L=16$: Start and repeat with: $2u - 6o$.
- (17). $L=16 \longrightarrow R=17$: Start and repeat with: $2u - 6o$.
- (18). $R=17 \longrightarrow L=18$: Start and repeat with: $3u - 6o$.
- (19). $L=18 \longrightarrow R=19$: Start and repeat with: $3u - 6o$.
- (20). $L=0 \longrightarrow R=23$: Start and repeat with: $4o - 6u$.
- (21). $R=23 \longrightarrow L=22$: Start and repeat with: $4o - 6u$.
- (22). $L=22 \longrightarrow R=21$: Start and repeat with: $5o - 6u$.

- (23). $R=21 \rightarrow L=20$: Start and repeat with: $5o - 6u$.
 (24). $L=20 \rightarrow R=19$: Start and repeat with: $6o - 6u$.

$b=12$:

$p = 12n + 5$; hence $r = 5$. For 3-row algorithm-diagram see pg. 41.

Place string-length position $\frac{19}{24}l$ at the left bight-boundary position 0. Braid first 19 half-cycles upwards; then braid the half-cycles 20, 21, 22, 23 and 24 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=5$: Free Run.
- (2). $R=5 \rightarrow L=10$: Free Run.
- (3). $L=10 \rightarrow R=15$: Free Run.
- (4). $R=15 \rightarrow L=20$: Free Run.
- (5). $L=20 \rightarrow R=1$: Free Run.
- (6). $R=1 \rightarrow L=6$: Free Run.
- (7). $L=6 \rightarrow R=11$: Free Run.
- (8). $R=11 \rightarrow L=16$: Free Run.
- (9). $L=16 \rightarrow R=21$: Free Run.
- (10). $R=21 \rightarrow L=2$: Free Run.
- (11). $L=2 \rightarrow R=7$: Free Run.
- (12). $R=7 \rightarrow L=12$: Free Run.
- (13). $L=12 \rightarrow R=17$: Free Run.
- (14). $R=17 \rightarrow L=22$: Start with: $2o$; repeat with: $u - 6o$.
- (15). $L=22 \rightarrow R=3$: Start with: $2o$; repeat with: $u - 6o$.
- (16). $R=3 \rightarrow L=8$: Start with: $u - 2o$; repeat with: $u - 4o - u - 2o$.
- (17). $L=8 \rightarrow R=13$: Start with: $u - 2o$; repeat with: $u - 4o - u - 2o$.
- (18). $R=13 \rightarrow L=18$: Start with: $u - 2o$; repeat with: $u - o - u - 3o - u - 2o$.
- (19). $L=18 \rightarrow R=23$: Start with: $u - 2o$; repeat with: $u - o - u - 3o - u - 2o$.
- (20). $L=0 \rightarrow R=19$: Start with: $o - u - o - u$;
repeat with: $o - u - o - 3u - o - u - o - u$.
- (21). $R=19 \rightarrow L=14$: Start with: $o - u - o - u$;
repeat with: $o - u - o - 3u - o - u - o - u$.
- (22). $L=14 \rightarrow R=9$: Start with: $o - u - o - u$;
repeat with: $o - u - o - u - o - 2u - o - u - o - u$.
- (23). $R=9 \rightarrow L=4$: Start with: $o - u - o - u$;
repeat with: $o - u - o - u - o - 2u - o - u - o - u$.
- (24). $L=4 \rightarrow R=23$: Start with: $o - u - o - u$;
repeat with: $2o - u - o - u - o - 2u - o - u - o - u$.

$b=12$:

$p = 12n + 7$; hence $r = 7$. For 3-row algorithm-diagram see pg. 41.

Place string-length position $\frac{19}{24}l$ at the left bight-boundary position 0. Braid first 19 half-cycles upwards; then braid the half-cycles 20, 21, 22, 23 and 24 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=7$: Free Run.
- (2). $R=7 \rightarrow L=14$: Free Run.
- (3). $L=14 \rightarrow R=21$: Free Run.
- (4). $R=21 \rightarrow L=4$: Free Run.
- (5). $L=4 \rightarrow R=11$: Free Run.

- (6). $R=11 \rightarrow L=18$: Free Run.
- (7). $L=18 \rightarrow R=1$: Free Run.
- (8). $R=1 \rightarrow L=8$: Free Run.
- (9). $L=8 \rightarrow R=15$: Free Run.
- (10). $R=15 \rightarrow L=22$: Free Run.
- (11). $L=22 \rightarrow R=5$: Free Run.
- (12). $R=5 \rightarrow L=12$: Free Run.
- (13). $L=12 \rightarrow R=19$: Free Run.
- (14). $R=19 \rightarrow L=2$: Start with: $3o - u$; repeat with: $6o - u$.
- (15). $L=2 \rightarrow R=9$: Start with: $3o - u$; repeat with: $6o - u$.
- (16). $R=9 \rightarrow L=16$: Start with: $3o - u$; repeat with: $2o - u - 4o - u$.
- (17). $L=16 \rightarrow R=23$: Start with: $3o - u$; repeat with: $2o - u - 4o - u$.
- (18). $R=23 \rightarrow L=6$: Start with: $2o - u - o - u$;
repeat with: $2o - u - 3o - u - o - u$.
- (19). $L=6 \rightarrow R=13$: Start with: $2o - u - o - u$;
repeat with: $2o - u - 3o - u - o - u$.
- (20). $L=0 \rightarrow R=17$: Start with: $2u - o - u - o$;
repeat with: $u - o - u - o - 3u - o - u - o$.
- (21). $R=17 \rightarrow L=10$: Start with: $2u - o - u - o$;
repeat with: $u - o - u - o - 3u - o - u - o$.
- (22). $L=10 \rightarrow R=3$: Start with: $u - o - u - o - u - o$;
repeat with: $u - o - u - o - 2u - o - u - o - u - o$.
- (23). $R=3 \rightarrow L=20$: Start with: $u - o - u - o - u - o$;
repeat with: $u - o - u - o - 2u - o - u - o - u - o$.
- (24). $L=20 \rightarrow R=13$: Start with: $u - o - u - o - u$;
repeat with: $2o - u - o - u - o - 2u - o - u - o - u$;
finish with: o .

$b=12$:

$p = 12n + 11$; hence $r = 11$. For 3-row algorithm-diagram see pg. 41.

Place string-length position $\frac{19}{24}l$ at the left bight-boundary position 0. Braid first 19 half-cycles upwards; then braid the half-cycles 20, 21, 22, 23 and 24 downwards.

The half-cycle algorithms for this knot are:

- (1). $L=0 \rightarrow R=11$: Free Run.
- (2). $R=11 \rightarrow L=22$: Free Run.
- (3). $L=22 \rightarrow R=9$: Free Run.
- (4). $R=9 \rightarrow L=20$: Free Run.
- (5). $L=20 \rightarrow R=7$: Free Run.
- (6). $R=7 \rightarrow L=18$: Free Run.
- (7). $L=18 \rightarrow R=5$: Free Run.
- (8). $R=5 \rightarrow L=16$: Free Run.
- (9). $L=16 \rightarrow R=3$: Free Run.
- (10). $R=3 \rightarrow L=14$: Free Run.
- (11). $L=14 \rightarrow R=1$: Free Run.
- (12). $R=1 \rightarrow L=12$: Free Run.
- (13). $L=12 \rightarrow R=23$: Free Run.
- (14). $R=23 \rightarrow L=10$: Start with: $5o - u$; repeat with: $6o - u$.
- (15). $L=10 \rightarrow R=21$: Start with: $5o - u$; repeat with: $6o - u$.

- (16). $R=21 \longrightarrow L=8$: Start with: $5o - 2u$; repeat with: $6o - 2u$.
- (17). $L=8 \longrightarrow R=19$: Start with: $5o - 2u$; repeat with: $6o - 2u$.
- (18). $R=19 \longrightarrow L=6$: Start with: $5o - 3u$; repeat with: $6o - 3u$.
- (19). $L=6 \longrightarrow R=17$: Start with: $5o - 3u$; repeat with: $6o - 3u$.
- (20). $L=0 \longrightarrow R=13$: Start with: $5u - 4o$; repeat with: $6u - 4o$.
- (21). $R=13 \longrightarrow L=2$: Start with: $5u - 4o$; repeat with: $6u - 4o$.
- (22). $L=2 \longrightarrow R=15$: Start with: $5u - 5o$; repeat with: $6u - 5o$.
- (23). $R=15 \longrightarrow L=4$: Start with: $5u - 5o$; repeat with: $6u - 5o$.
- (24). $L=4 \longrightarrow R=17$: Start with: $5u$; repeat with: $6o - 6u$; finish with: $5o$.

The 3-row algorithm-diagrams associated with the Column-coded Long Regular Knots discussed in this Chapter are presented on pages 33 to 41, while the grid-diagrams of these knots are depicted on pages 42 to 49.

L → R	
0	1
	↘
↗	↘
↗	
1	0
← R L	

$$b=2 : p=2n+1$$

L → R		
0	2	1
	↘	↘
↗	↘	↘
↗		
2	0	1
← R L		

$$b=3 : p=3n+1$$

L → R		
0	1	2
	↘	↘
↗	↘	↘
↗	↘	
2	1	0
← R L		

$$b=3 : p=3n+2$$

L → R			
0	3	2	1
	↘	↘	↗
↗	↘	↘	↗
↗			
3	0	1	2
← R L			

$$b=4 : p=4n+1$$

L → R			
0	1	2	3
	↗	↘	↘
↗	↗	↘	↘
↗	↗	↘	
3	2	1	0
← R L			

$$b=4 : p=4n+3$$

L → R				
0	4	3	2	1
	↘	↘	↘	↗
↗	↘	↘	↘	↗
↗				
4	0	1	2	3
← R L				

$$b=5 : p=5n+1$$

L → R				
0	2	4	1	3
	↘	↘	↗	↘
↗	↘	↘	↗	↘
↗	↘			
4	2	0	3	1
← R L				

$$b=5 : p=5n+2$$

L → R				
0	3	1	4	2
	↘	↗	↘	↘
↗	↘	↗	↘	↘
↗	↘	↗		
4	1	3	0	2
← R L				

$$b=5 : p=5n+3$$

L → R				
0	1	2	3	4
	↗	↘	↘	↘
↗	↗	↘	↘	↘
↗	↗	↘	↘	
4	3	2	1	0
← R L				

$$b=5 : p=5n+4$$

	$\xrightarrow{\quad L \quad R \quad}$				
0	5	4	3	2	1
	$\diagdown$	$\diagdown$	$\diagdown$	$\diagup$	$\diagup$
$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagup$	$\diagup$
$\diagup$					
5	0	1	2	3	4

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=6 : p=6n+1$$

	$\xrightarrow{\quad L \quad R \quad}$				
0	1	2	3	4	5
	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	
5	4	3	2	1	0

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=6 : p=6n+5$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	6	5	4	3	2	1
	$\diagdown$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagup$	$\diagup$
$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagup$	$\diagup$
$\diagup$						
6	0	1	2	3	4	5

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+1$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	3	6	2	5	1	4
	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagup$	$\diagdown$
$\diagup$	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagup$	$\diagdown$
$\diagup$	$\diagdown$					
6	3	0	4	1	5	2

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+2$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	2	4	6	1	3	5
	$\diagup$	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagdown$				
6	4	2	0	5	3	1

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+3$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	5	3	1	6	4	2
	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$	$\diagup$
$\diagup$	$\diagdown$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$	$\diagup$
$\diagup$	$\diagdown$	$\diagdown$	$\diagup$			
6	1	3	5	0	2	4

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+4$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	4	1	5	2	6	3
	$\diagdown$	$\diagup$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$
$\diagup$	$\diagdown$	$\diagup$	$\diagdown$	$\diagup$	$\diagdown$	$\diagdown$
$\diagup$	$\diagdown$	$\diagup$	$\diagdown$	$\diagup$		
6	2	5	1	4	0	3

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+5$$

	$\xrightarrow{\quad L \quad R \quad}$					
0	1	2	3	4	5	6
	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$	$\diagdown$
$\diagup$	$\diagup$	$\diagup$	$\diagdown$	$\diagdown$	$\diagdown$	
6	5	4	3	2	1	0

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=7 : p=7n+6$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline 0 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ \hline & \diagdown & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagup \\ \hline \diagup & & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagup \\ \hline \diagup & & & & & & & \\ \hline 7 & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=8 : p=8n+1$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline 0 & 5 & 2 & 7 & 4 & 1 & 6 & 3 \\ \hline & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & & & & & \\ \hline 7 & 2 & 5 & 0 & 3 & 6 & 1 & 4 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=8 : p=8n+3$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline 0 & 3 & 6 & 1 & 4 & 7 & 2 & 5 \\ \hline & \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagup & \diagdown & & & \\ \hline 7 & 4 & 1 & 6 & 3 & 0 & 5 & 2 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=8 : p=8n+5$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \hline & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \\ \hline 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=8 : p=8n+7$$

			$\xrightarrow{\quad L \quad R \quad}$					
0	8	7	6	5	4	3	2	1
	\	\	\	\	\	/	/	/
/	\	\	\	\	\	/	/	/
/								
8	0	1	2	3	4	5	6	7

$\xleftarrow{\quad L \quad R \quad}$

$$b=9 : p=9n+1$$

			$\xrightarrow{\quad L \quad R \quad}$					
0	4	8	3	7	2	6	1	5
	\	\	/	\	/	\	/	\
/	\	\	/	\	/	\	/	\
/	\							
8	4	0	5	1	6	2	7	3

$\xleftarrow{\quad L \quad R \quad}$

$$b=9 : p=9n+2$$

			$\xrightarrow{\quad L \quad R \quad}$					
0	2	4	6	8	1	3	5	7
	/	\	\	\	/	/	\	\
/	/	\	\	\	/	/	\	\
/	/	\	\					
8	6	4	2	0	7	5	3	1

$\xleftarrow{\quad L \quad R \quad}$

$$b=9 : p=9n+4$$

			$\xrightarrow{\quad L \quad R \quad}$					
0	7	5	3	1	8	6	4	2
	\	\	/	/	\	\	\	/
/	\	\	/	/	\	\	\	/
/	\	\	/	/				
8	1	3	5	7	0	2	4	6

$\xleftarrow{\quad L \quad R \quad}$

$$b=9 : p=9n+5$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|} \hline 0 & 5 & 1 & 6 & 2 & 7 & 3 & 8 & 4 \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & & \\ \hline 8 & 3 & 7 & 2 & 6 & 1 & 5 & 0 & 4 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=9 : p=9n+7$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|} \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \\ \hline 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=9 : p=9n+8$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagdown & & & & & & & & & \\ \hline 9 & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=10 : p=10n+1$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 3 & 6 & 9 & 2 & 5 & 8 & 1 & 4 & 7 \\ \hline \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagdown & \diagup & \diagdown & & & & & & & \\ \hline 9 & 6 & 3 & 0 & 7 & 4 & 1 & 8 & 5 & 2 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=10 : p=10n+3$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 7 & 4 & 1 & 8 & 5 & 2 & 9 & 6 & 3 \\ \hline & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup & & & \\ \hline 9 & 2 & 5 & 8 & 1 & 4 & 7 & 0 & 3 & 6 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=10 : p=10n+7$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ \hline & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \\ \hline 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=10 : p=10n+9$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 10 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ \hline & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagup & \diagup \\ \hline \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagup & \diagup \\ \hline \diagup & & & & & & & & & & \\ \hline 10 & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=11 : p=11n+1$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 5 & 10 & 4 & 9 & 3 & 8 & 2 & 7 & 1 & 6 \\ \hline & \diagdown & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagdown & & & & & & & & & \\ \hline 10 & 5 & 0 & 6 & 1 & 7 & 2 & 8 & 3 & 9 & 4 \\ \hline \end{array} \end{array}$$

$$\xleftarrow{\quad L \quad R \quad}$$

$$b=11 : p=11n+2$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 7 & 3 & 10 & 6 & 2 & 9 & 5 & 1 & 8 & 4 \\ \hline & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagup & & & & & & & & \\ \hline 10 & 3 & 7 & 0 & 4 & 8 & 1 & 5 & 9 & 2 & 6 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad R \quad} \\ b=11 : p=11n+3 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 8 & 5 & 2 & 10 & 7 & 4 & 1 & 9 & 6 & 3 \\ \hline & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup \\ \hline \diagup & \diagdown & \diagdown & \diagup & & & & & & & \\ \hline 10 & 2 & 5 & 8 & 0 & 3 & 6 & 9 & 1 & 4 & 7 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad R \quad} \\ b=11 : p=11n+4 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 2 & 4 & 6 & 8 & 10 & 1 & 3 & 5 & 7 & 9 \\ \hline & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagdown & \diagdown & & & & & & \\ \hline 10 & 8 & 6 & 4 & 2 & 0 & 9 & 7 & 5 & 3 & 1 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad R \quad} \\ b=11 : p=11n+5 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 9 & 7 & 5 & 3 & 1 & 10 & 8 & 6 & 4 & 2 \\ \hline & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup \\ \hline \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup \\ \hline \diagup & \diagdown & \diagdown & \diagdown & \diagup & \diagup & & & & & \\ \hline 10 & 1 & 3 & 5 & 7 & 9 & 0 & 2 & 4 & 6 & 8 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad R \quad} \\ b=11 : p=11n+6 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 3 & 6 & 9 & 1 & 4 & 7 & 10 & 2 & 5 & 8 \\ \hline & \diagup & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagdown & \diagup & \diagup & \diagdown & & & & \\ \hline 10 & 7 & 4 & 1 & 9 & 6 & 3 & 0 & 8 & 5 & 2 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad} \quad \xrightarrow{\quad R \quad} \\ b=11 : p=11a+7 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 4 & 8 & 1 & 5 & 9 & 2 & 6 & 10 & 3 & 7 \\ \hline & \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown \\ \hline \diagup & \diagup & \diagdown & \diagup & \diagdown & \diagdown & \diagup & \diagdown & & & \\ \hline 10 & 6 & 2 & 9 & 5 & 1 & 8 & 4 & 0 & 7 & 3 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad} \quad \xrightarrow{\quad R \quad} \\ b=11 : p=11a+8 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 6 & 1 & 7 & 2 & 8 & 3 & 9 & 4 & 10 & 5 \\ \hline & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagdown \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagdown \\ \hline \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & & \\ \hline 10 & 4 & 9 & 3 & 8 & 2 & 7 & 1 & 6 & 0 & 5 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad} \quad \xrightarrow{\quad R \quad} \\ b=11 : p=11a+9 \end{array}$$

$$\begin{array}{c} \xrightarrow{\quad L \quad R \quad} \\ \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ \hline & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \\ \hline \diagup & \diagup & \diagup & \diagup & \diagup & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \\ \hline 10 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ \hline \end{array} \end{array}$$

$$\begin{array}{c} \xleftarrow{\quad L \quad} \quad \xrightarrow{\quad R \quad} \\ b=11 : p=11a+10 \end{array}$$

L $\xrightarrow{\hspace{1.5cm}}$ R

0	11	10	9	8	7	6	5	4	3	2	1
	\	\	\	\	\	\	/	/	/	/	/
/	\	\	\	\	\	\	/	/	/	/	/
/											
11	0	1	2	3	4	5	6	7	8	9	10

L $\xleftarrow{\hspace{1.5cm}}$ R
 $b=12 : p=12n+1$

L $\xrightarrow{\hspace{1.5cm}}$ R

0	7	2	9	4	11	6	1	8	3	10	5
	\	/	\	/	\	\	/	\	/	\	/
/	\	/	\	/	\	\	/	\	/	\	/
/	\	/	\	/							
11	4	9	2	7	0	5	10	3	8	1	6

L $\xleftarrow{\hspace{1.5cm}}$ R
 $b=12 : p=12n+5$

L $\xrightarrow{\hspace{1.5cm}}$ R

0	5	10	3	8	1	6	11	4	9	2	7
	/	\	/	\	/	\	\	/	\	/	\
/	/	\	/	\	/	\	\	/	\	/	\
/	/	\	/	\	/	\					
11	8	1	8	3	10	5	0	7	2	9	4

L $\xleftarrow{\hspace{1.5cm}}$ R
 $b=12 : p=12n+7$

L $\xrightarrow{\hspace{1.5cm}}$ R

0	1	2	3	4	5	6	7	8	9	10	11
	/	/	/	/	/	\	\	\	\	\	\
/	/	/	/	/	/	\	\	\	\	\	\
/	/	/	/	/	/	\	\	\	\	\	
11	10	9	8	7	6	5	4	3	2	1	0

L $\xleftarrow{\hspace{1.5cm}}$ R
 $b=12 : p=12n+11$



$b=2 : p=2n+1$



$b=3 : p=3n+1$



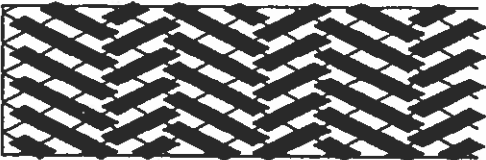
$b=3 : p=3n+2$



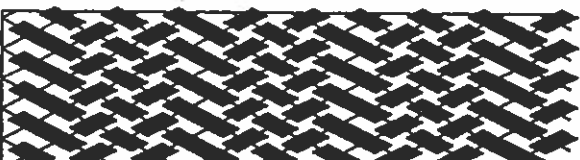
$b=4 : p=4n+1$



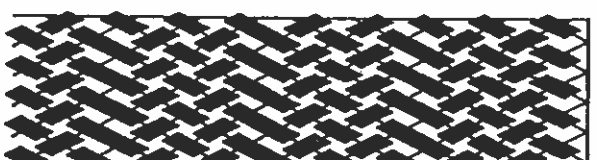
$b=4 : p=4n+3$



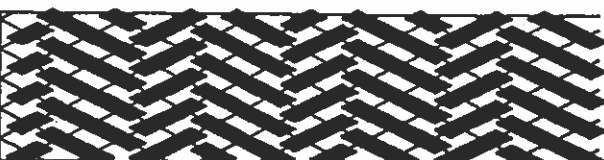
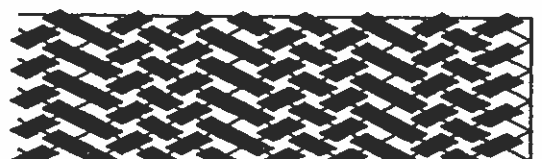
$b=5 : p=5n+1$



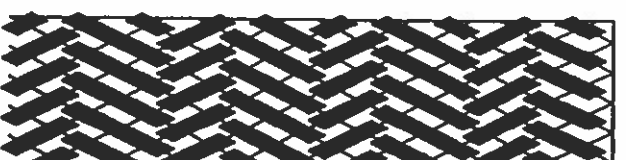
$b=5 : p=5n+2$

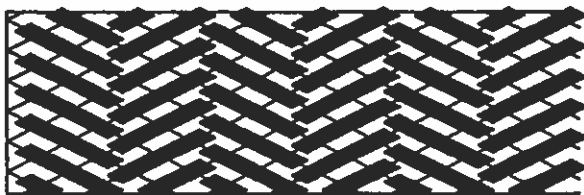


$b=5 : p=5n+3$

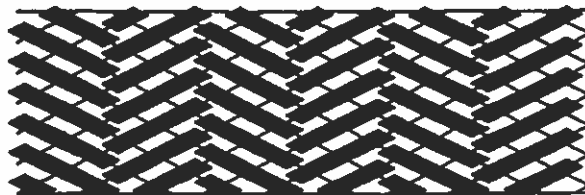


$b=5 : p=5n+4$

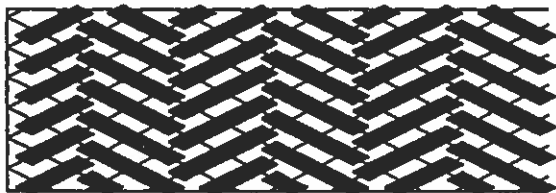




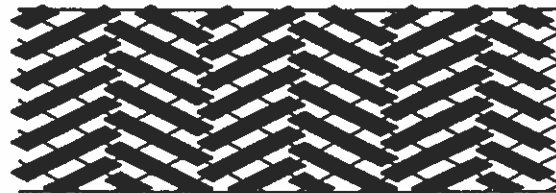
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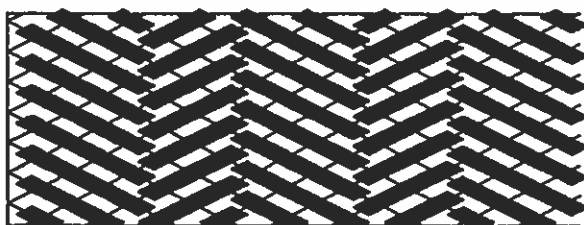
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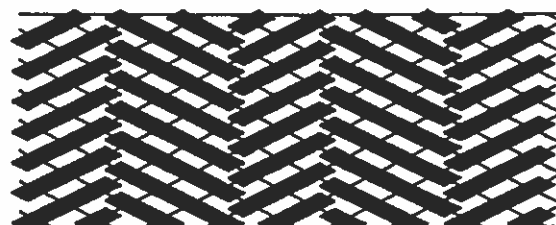
$b=7 : p=7n+1$



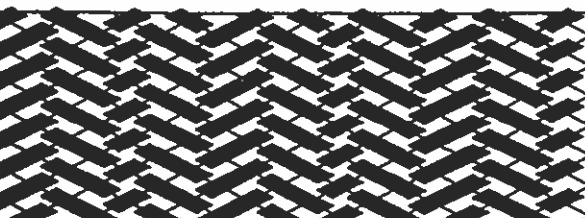
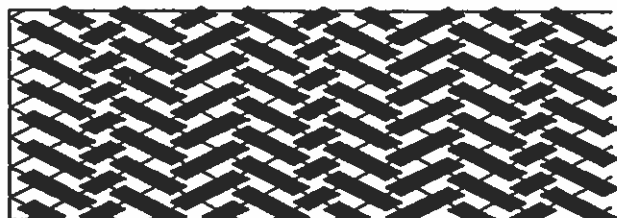
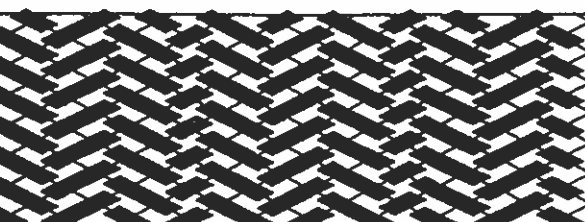
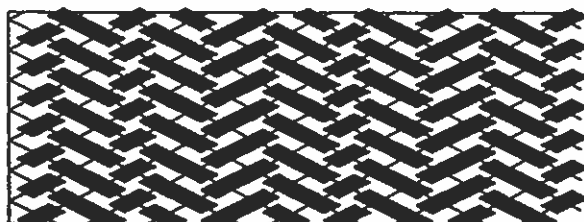
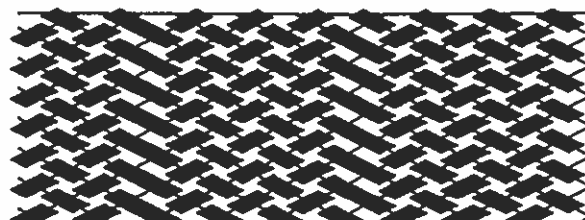
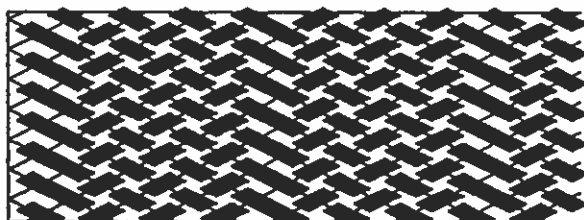
$b=7 : p=7n+2$

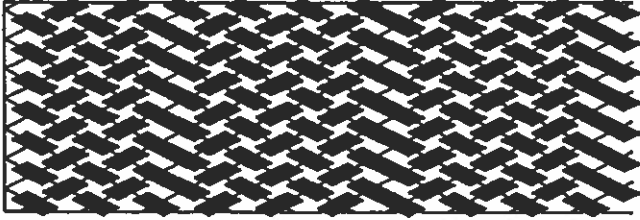


$b=7 : p=7n+3$

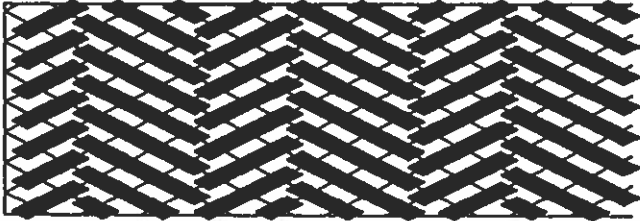
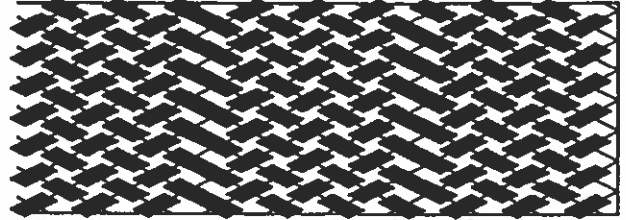


$b=7 : p=7n+4$

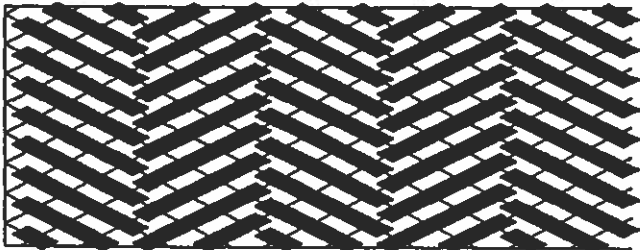
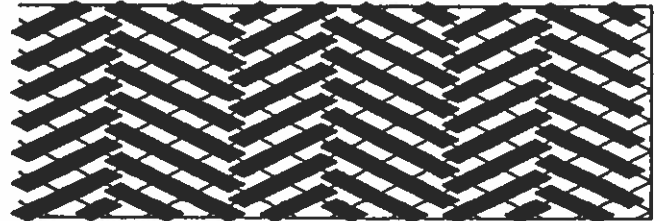




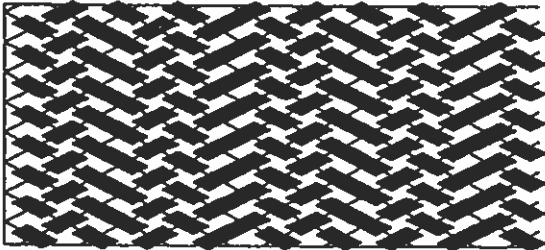
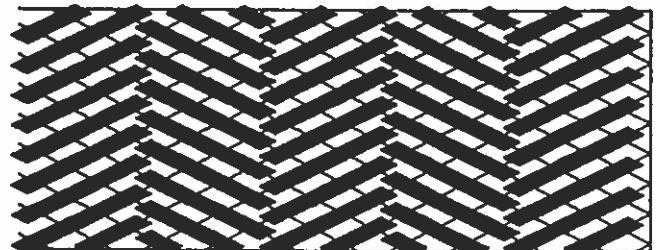
$b=7$: $p=7n+5$



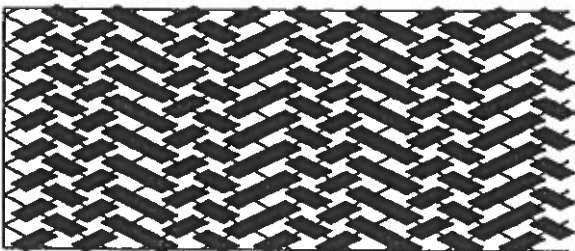
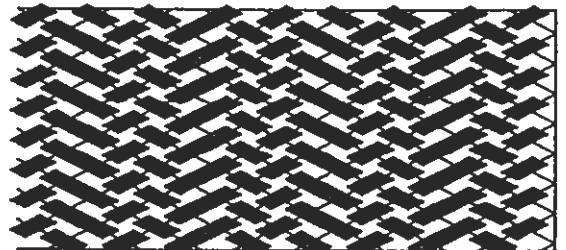
$b=7$: $p=7n+6$



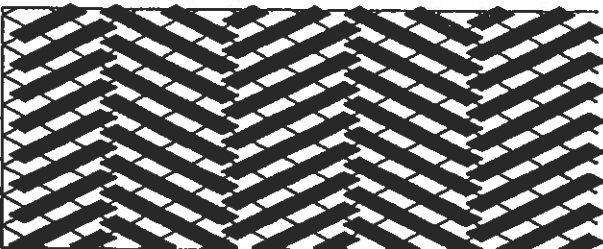
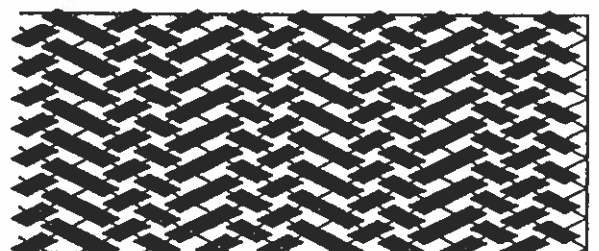
$b=8$: $p=8n+1$



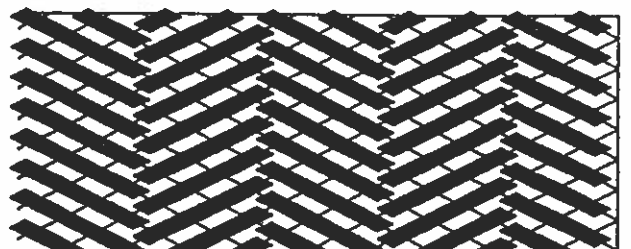
$b=8$: $p=8n+3$

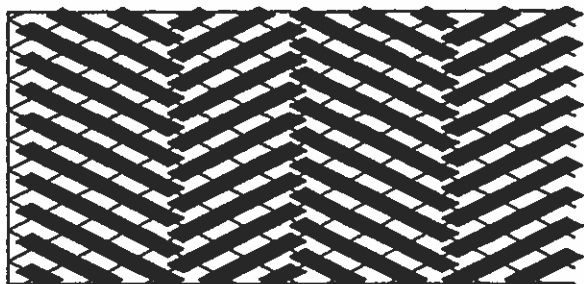


$b=8$: $p=8n+5$

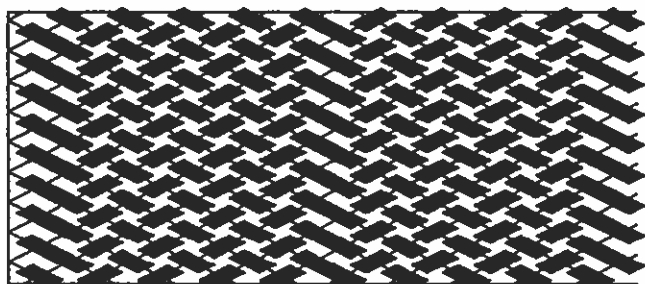
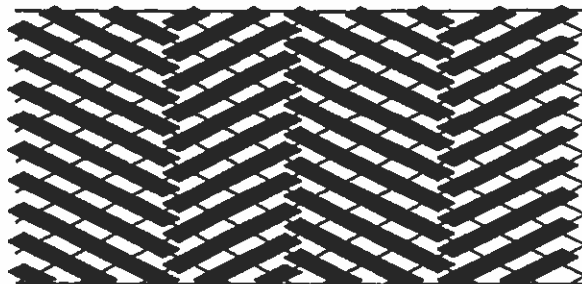


$b=8$: $p=8n+7$

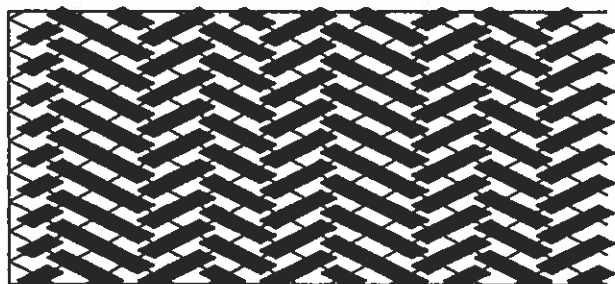
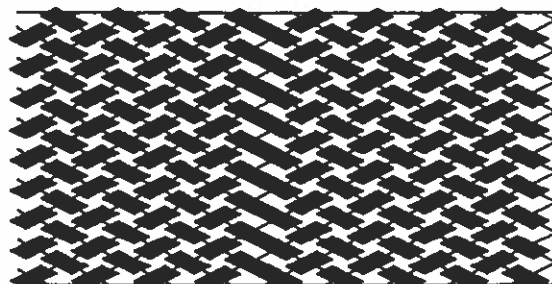




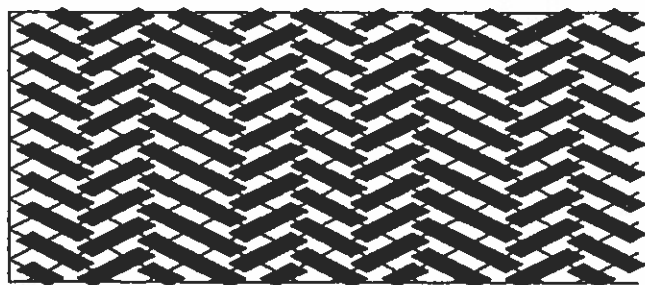
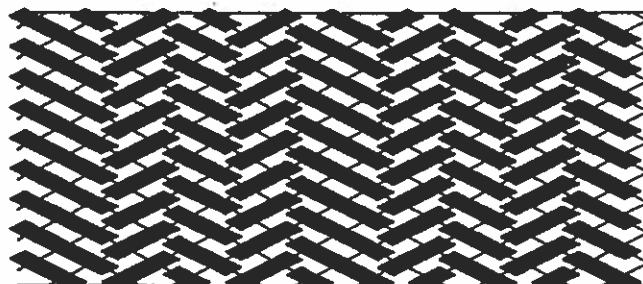
$b=9$: $p=9n+1$



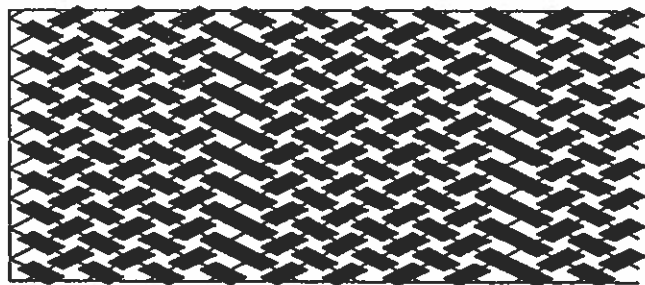
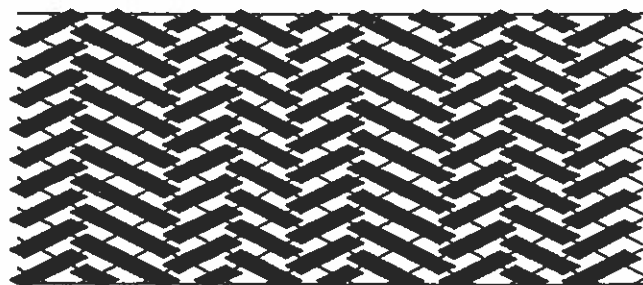
$b=9$: $p=9n+2$



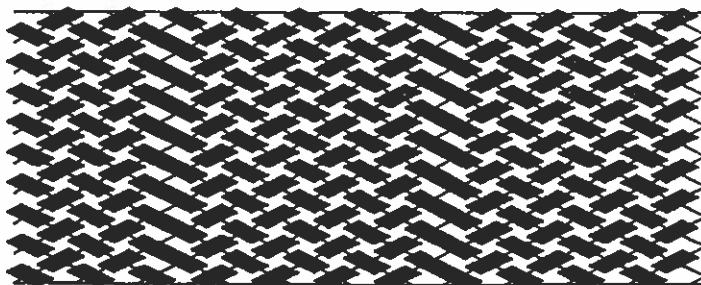
$b=9$: $p=9n+4$

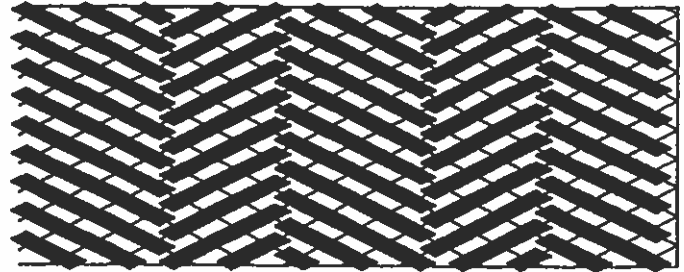
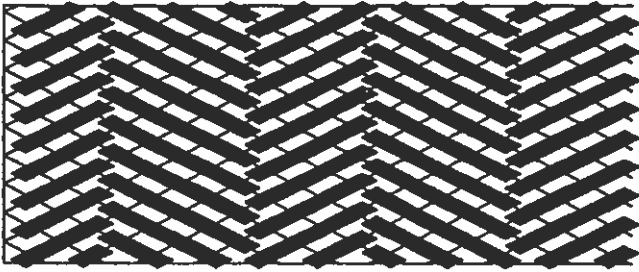


$b=9$: $p=9n+5$

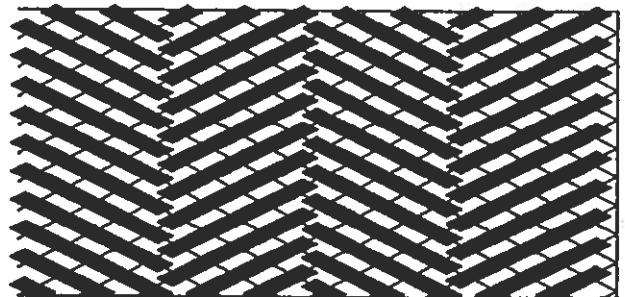
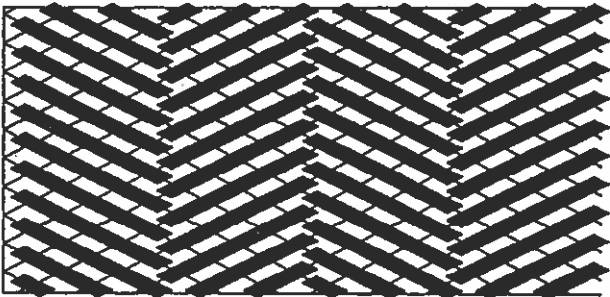


$b=9$: $p=9n+7$

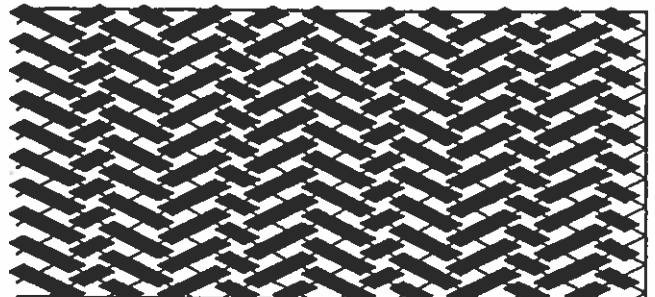
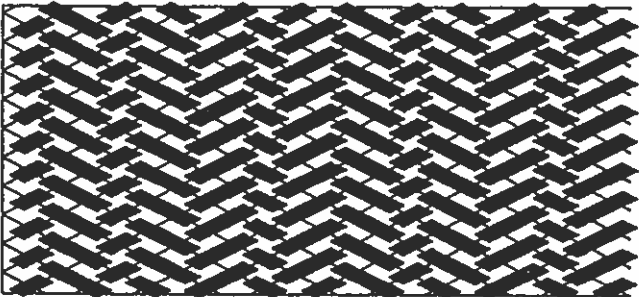




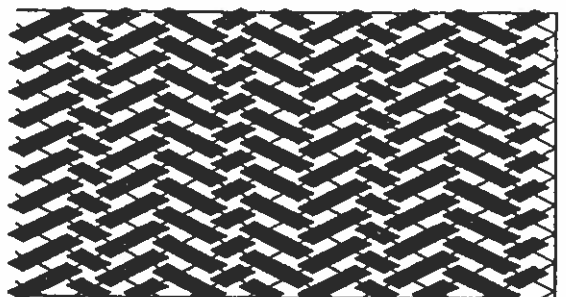
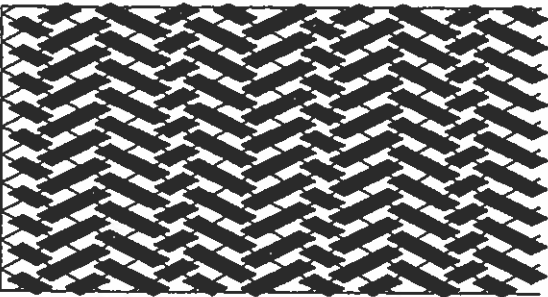
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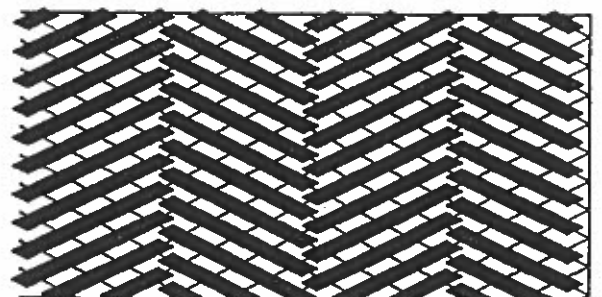
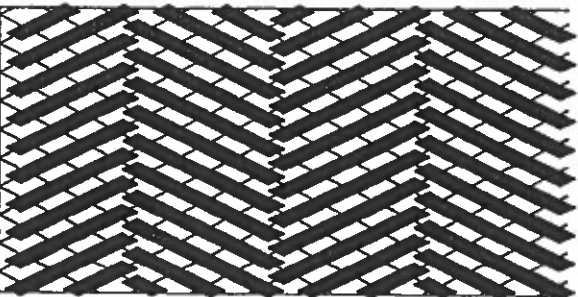
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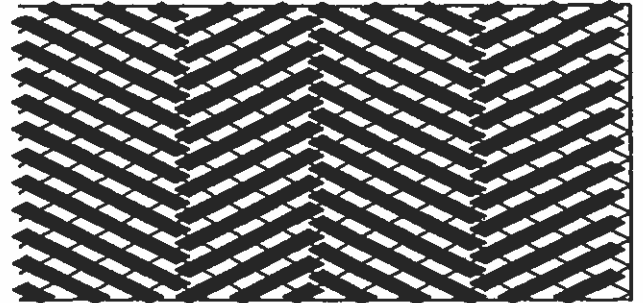
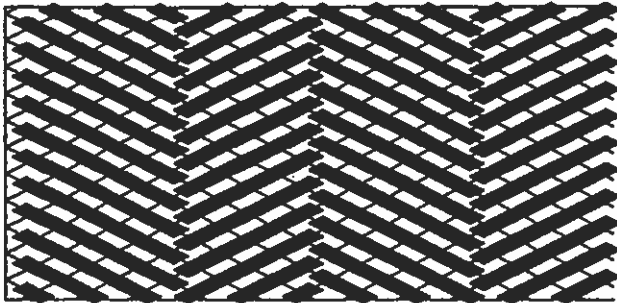
$b=10 : p=10n+3$



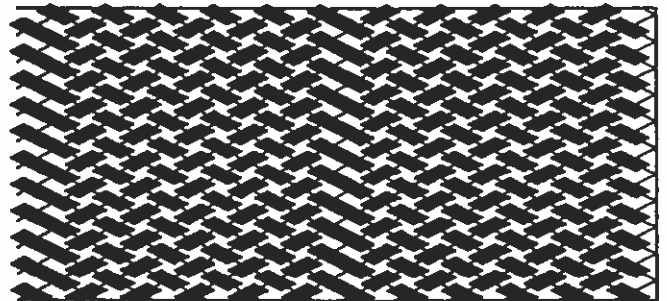
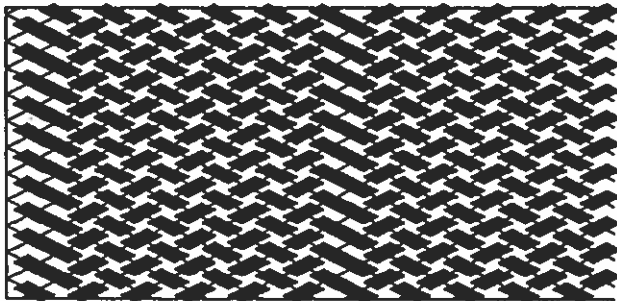
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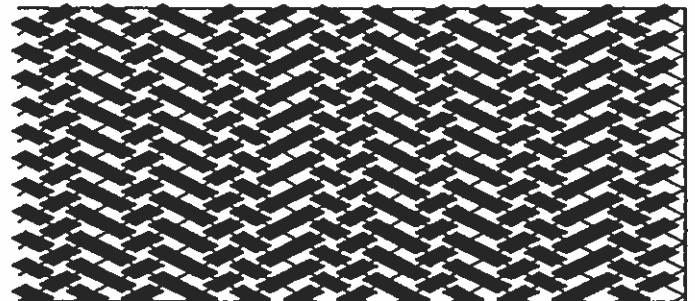
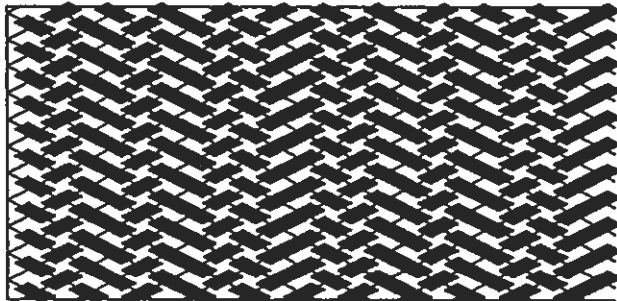
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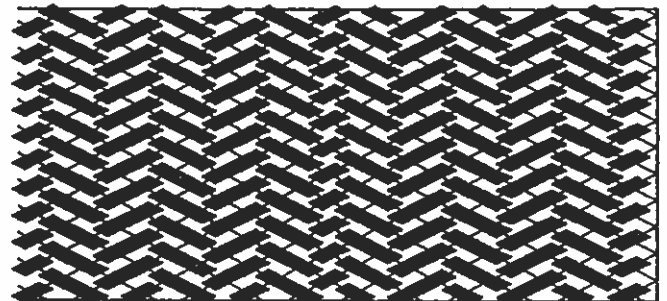
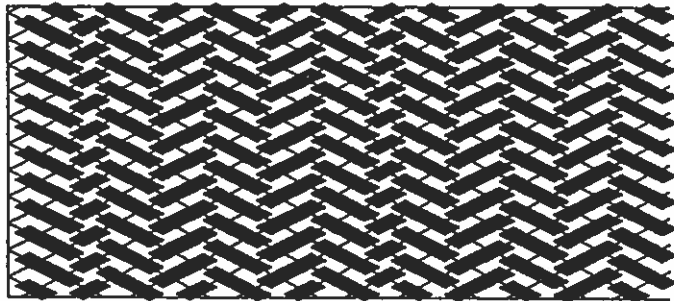
$b=11 : p=11n+1$



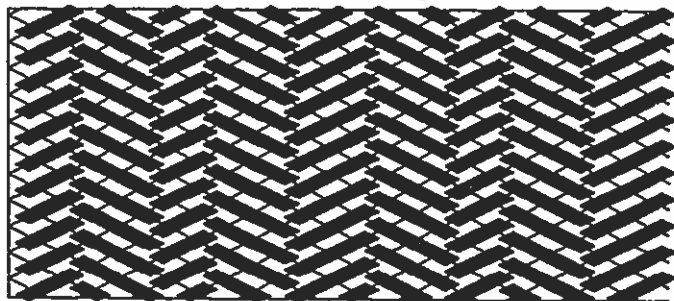
$b=11 : p=11n+2$



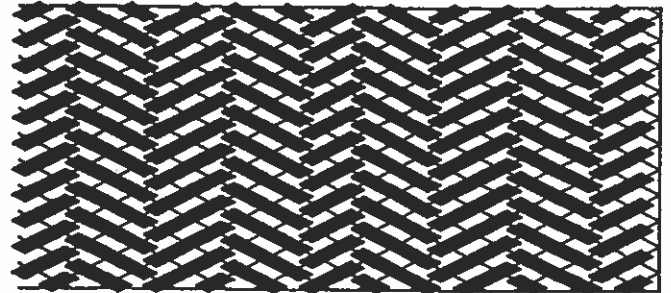
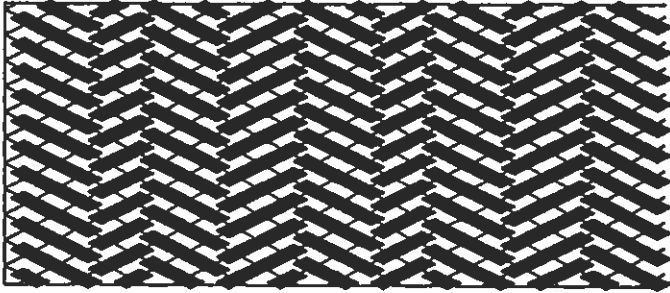
$b=11 : p=11n+3$



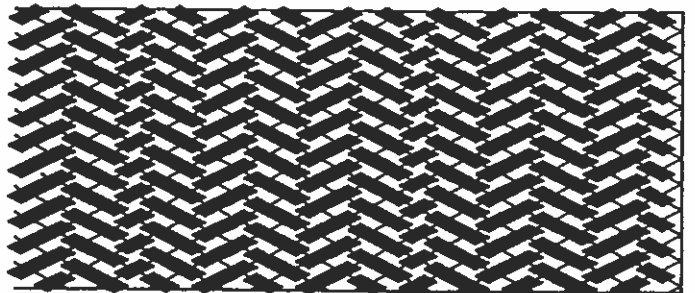
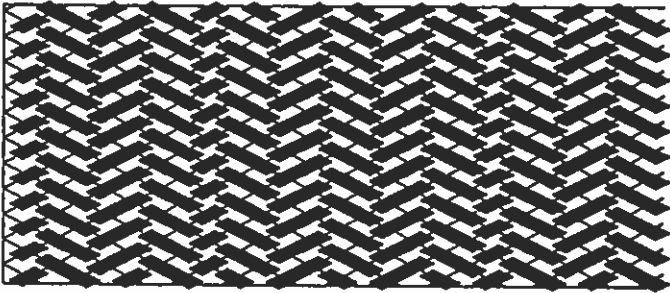
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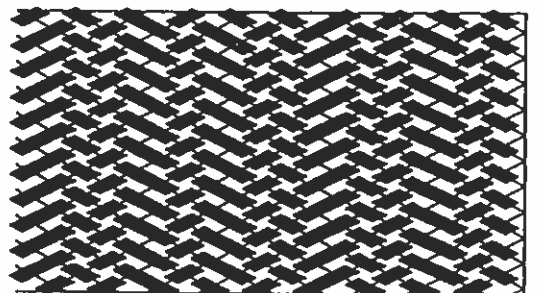
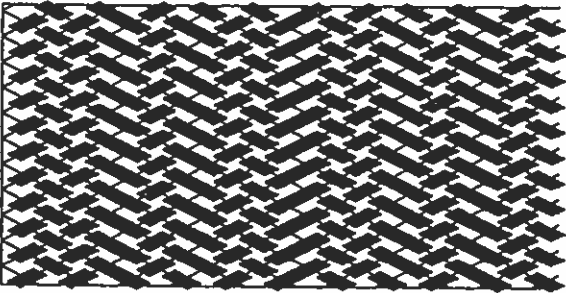
$b=11 : p=11n+5$



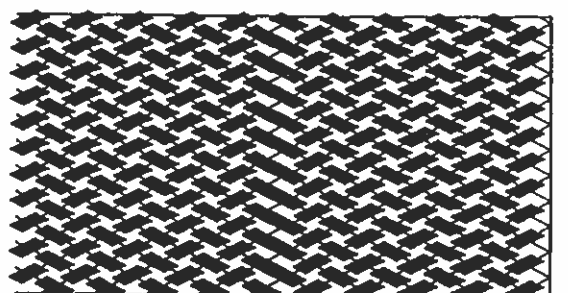
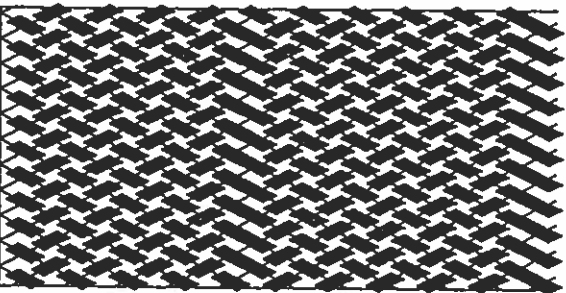
$b=11 : p=11n+6$



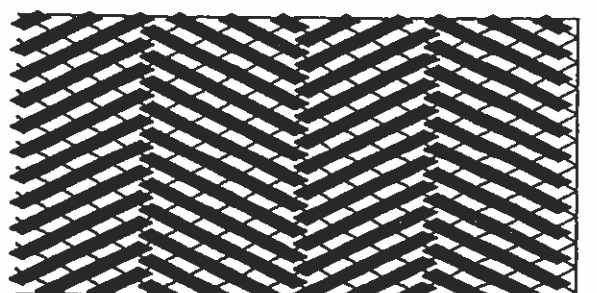
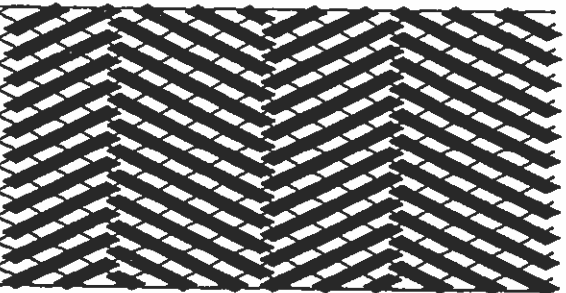
$b=11 : p=11n+7$



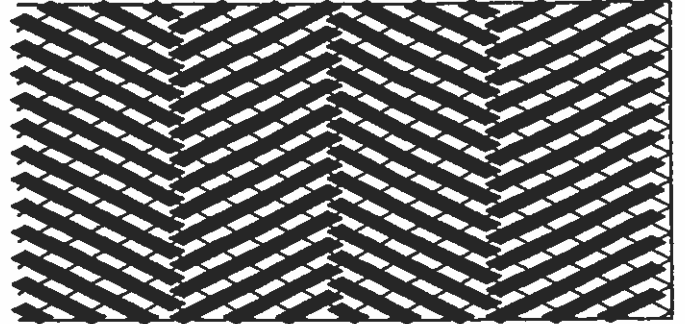
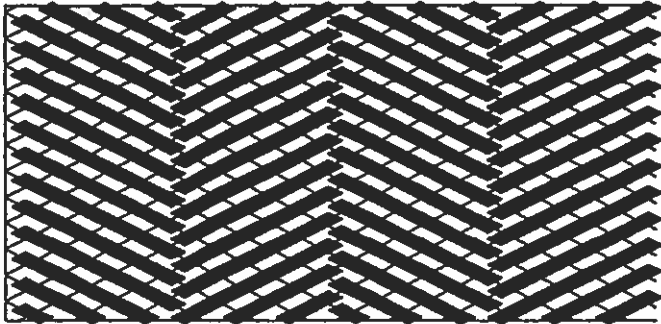
$b=11 : p=11n+8$



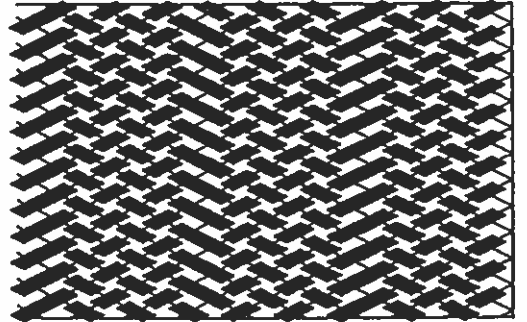
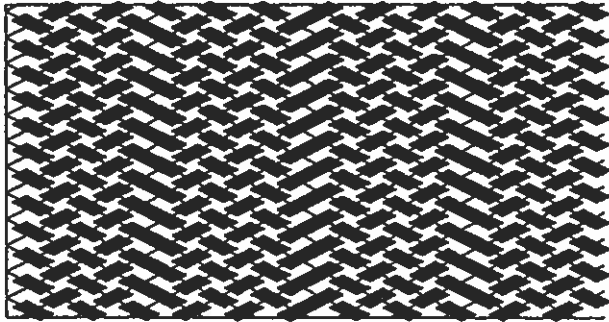
$b=11 : p=11n+9$



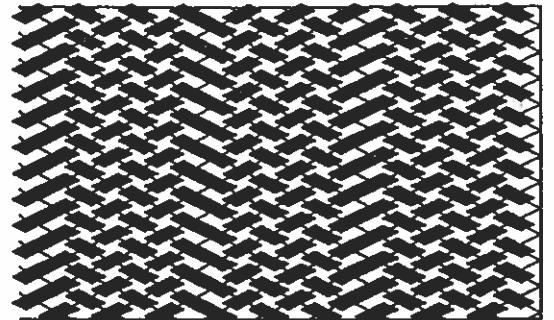
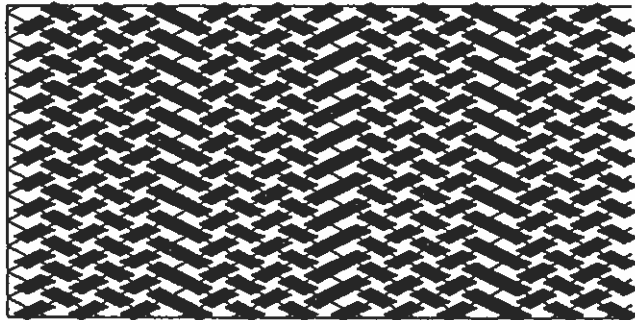
$b=11 : p=11n+10$



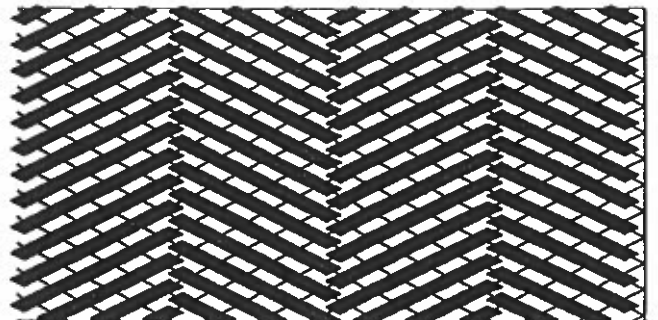
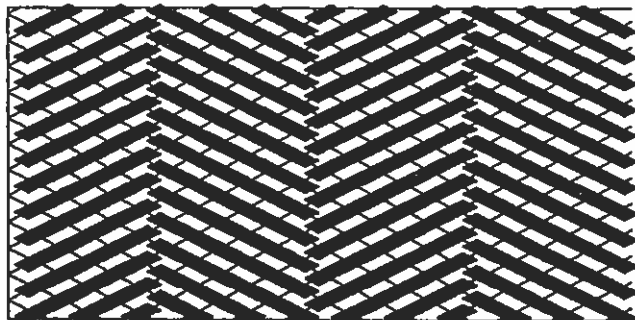
$b=12 : p=12n+1$



$b=12 : p=12n+5$



$b=12 : p=12n+7$



$b=12 : p=12n+11$

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